2001 INTERIM GROUNDWATER MONITORING REPORT

FOREST WASTE DISPOSAL SITE
OTISVILLE, MICHIGAN

Prepared For:
Forest Waste Coordinating Committee

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EXECUTIVE SUMMARY

Conestoga-Rovers & Associates (CRA) conducted the interim groundwater monitoring event at the Forest Waste Disposal Site (Site) on behalf of the Forest Waste Coordinating Committee (FWCC) from June 25 to June 28, 2001. Groundwater samples from 4 monitoring wells (MW84-1S, MW84-2S, MW85-2S, and MW95-1S) were analyzed for Volatile Organic Compounds (VOCs) and a subset of two of these wells (MW84-1S and MW95-1S) were also sampled for Natural Attenuation parameters. Based on a review of the June 2001 data, monitoring well MW95-1S was re-sampled on August 21 and analyzed for VOCs.

The results of the interim groundwater monitoring event and recommendations pertaining to this event are presented in detail in this report, and are summarized below.

GROUNDWATER FLOW DIRECTION

A complete round of groundwater level data was collected by CRA during the 2001 interim groundwater monitoring event. Groundwater flow direction in the Shallow Aquifer and hydraulic gradients were found to be consistent with those reported during previous events. Groundwater flow north of the landfill flows to the north and northeast in the Shallow Aquifer, and groundwater flow in the Deep Aquifer is generally east to west.

VOLATILE ORGANIC COMPOUNDS

Concentrations of all VOCs were below detection limits in MW84-2S and MW85-2S. 1,2-dichloroethane was detected in the MW84-1S at a level well below Part 201 GSI criteria. *1,1-dichloroethane, chloroethane, cis-1,2-dichloroethene and methylene* chloride were detected at MW95-1S, below applicable Part 201 GSI criteria. Ethylbenzene, toluene, vinyl chloride, xylenes (total) and carbon tetrachloride exceeded their respective Part 201 GSI Criteria in MW95-1S. Detailed results can be found in Table 2.3.

All of the detected BTEX parameters at MW95-1S were lower than those observed during previous sampling events. Chlorinated VOCs detected at MW95-1S in June and August 2001 were three orders of magnitude higher than those reported during the last annual monitoring event in October 1999.

NATURAL ATTENUATION PARAMETERS

The analytical results for the natural attenuation parameters (acid digestion, alkalinity, calcium, chloride, DOC, hardness, iron, magnesium, manganese, nitrate-nitrites, potassium, sodium, sulfate, and sulfide) for MW84-1S and MW95-1S were comparable but slightly lower than those obtained during the previous event, except for sodium, which was slightly higher. The applicable groundwater criterion for each general chemistry parameter was not exceeded in any of the groundwater samples. The data indicate that the conditions in the Shallow Aquifer are conducive to the degradation of VOCs. A full evaluation of these parameters will be presented in the summary report for the north plume investigations.

RECOMMENDATIONS

A Summary Report, an Evaluation of Remedial Measures and a Long-Term Monitoring Plan will be submitted to the United States Environmental Protection Agency (U.S. EPA) in January 2002 upon completion of the current investigations.

The need for further interior monitoring, if any, will be assessed following the review of all additional investigation data.

1.0 INTRODUCTION

This report summarizes the results of the interim groundwater monitoring event for the Groundwater Operable Unit Remedial Action at the Forest Waste Disposal Site (Site) located near Otisville, Michigan. It was originally intended to conduct this monitoring event in September 2000. However, a number of monitoring wells were inadvertently overlooked during the field work, which focused on the northern plume.

The Groundwater Monitoring Program (Program) at the Site was initially based on the Groundwater Monitoring Manual (Manual), dated November 20, 1989. The Manual in turn was based on the Remedial Investigation (RI) data and did not consider the impacted groundwater north of the landfill. As a result, the 1989 program did not monitor the most relevant areas of the Site. Based on this fact, the Forest Waste Coordinating Committee requested an interim modification of the requirements of the monitoring program in a letter dated March 22, 2000 and revised on April 17, 2000. The modification was approved by the United States Environmental Protection Agency (U.S. EPA) for this event.

Conestoga-Rovers & Associates (CRA) initiated the groundwater sampling activities on June 25 and completed them on June 28, 2001.

1.1 AUTHORIZATION

CRA completed the June 2001 interim groundwater sampling event on behalf of the Forest Waste Coordinating Committee (FWCC). This work was completed in accordance with the Groundwater Monitoring Manual (CH2M Hill, November 20, 1989), as amended, and the Quality Assurance Project Plan (QAPP, CH2M Hill, September 29, 1989), which define and describe the groundwater monitoring program for the Site. Both documents were developed for, and approved by, U.S. EPA.

1.2 SITE DESCRIPTION

The Site is located in Forest Township, Genesee County, Michigan. The Site is approximately 112-acres in size and contains an approximately 10-acre landfill and a 1-acre former lagoon area, both of which have been remediated pursuant to remedial actions under the Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA) of 1980, 42 USC § 9601. The Site is surrounded by rural

residential land, farm land, and undeveloped wood lots. A Site plan, showing the monitoring well sample network, is presented on Figure 1.1.

1.3 PURPOSE AND SCOPE OF WORK

The primary purpose of this groundwater sampling event is to monitor solute concentrations downgradient from the landfill. The scope of work for the interim groundwater sampling event consisted of the following activities:

- inspection of the Site monitoring well and piezometer conditions;
- purging and sampling of groundwater for laboratory analysis from four monitoring wells;
- data validation of laboratory analytical data;
- database management of laboratory analytical data;
- comparison of validated analytical data to Part 201 GSI Criteria; and
- documentation and reporting of sampling activities, field and analytical data, results of data evaluations, and recommendations.

2.0 GROUNDWATER MONITORING RESULTS

CRA collected groundwater level data from existing monitoring wells and piezometers at the Site. Groundwater samples from the four monitoring wells (MW84-1S, MW84-2S, MW85-2S, and MW95-1S) were analyzed for volatile organic compounds (VOCs). A subset of two monitoring wells (MW84-1S and MW95-1S) wells were also sampled and analyzed for natural attenuation parameters including; acid digestion, alkalinity, calcium, chloride, dissolved organic carbon (DOC), hardness, iron, magnesium, manganese, nitrate-nitrites, potassium, sodium, sulfate and sulfide. A duplicate groundwater sample was collected from monitoring well MW84-1S for the monitoring program. MW95-1S was re-sampled in August 2001 to confirm the high concentrations of chlorinated VOCs detected in the June 2001.

Monitoring well purging, collection of field parameter data, and collection of groundwater samples were conducted in accordance with the methods described in the QAPP.

The June 2001 analytical data were reviewed for accuracy and conformance with the analytical methods and accepted laboratory procedures. Analytical data were assessed to determine whether any qualifications were necessary based on holding time criteria, instrument calibrations, method blank samples, ICP interference check samples, laboratory control samples, surrogate recoveries, matrix spikes, duplicate samples, internal standards, sample quantitations, field blanks, field duplicates, and trip blanks.

The data were found to exhibit acceptable levels of accuracy and precision as qualified in the data quality assessment and validation memorandum presented in Appendix A.

2.1 GROUNDWATER ELEVATIONS

CRA collected groundwater level measurements from 46 monitoring wells and piezometers at the Site. Groundwater levels in piezometers PZ96-7, PZ96-5, PZ96-8, PZ96-9, PZ97-1, and PZ97-10 were not measured because these piezometers could not be located. Groundwater levels for piezometers PZ96-3, PZ96-10, PZ96-11, and PZ97-7 were not measured because they had been either damaged or destroyed. Water level data was not collected from monitoring well M-1 and piezometers PZ97-6 and PZ97-12 because these wells/piezometers were dry. The depth to groundwater and groundwater elevations for the 2001 interim event are presented in Table 2.1.

The measured groundwater level data for the 2001 interim event were used to produce groundwater elevation contours for Shallow and Deep Aquifers. The groundwater elevation contours for the Shallow and Deep Aquifers are presented on Figures 2.1 and 2.2, respectively.

Figure 2.1 presents the potentiometric surface in the Shallow Aquifer in the vicinity of the Site. The Shallow Aquifer groundwater contours are consistent with those previously defined for the Shallow Aquifer. These indicate radial flow around the landfill with a strong, well defined flow path north of the landfill towards the north and northeast.

Figure 2.2 presents the potentiometric surface in the Deep Aquifer in the vicinity of the Site. The groundwater potentiometric contours for the Deep Aquifer indicate that north of the landfill groundwater flows generally towards the northwest and west, which is consistent with previous hydraulic monitoring events.

2.2 FIELD MONITORING

CRA collected field parameter data from the four monitoring wells (MW84-1S, MW84-2S, MW85-2S, and MW95-1S) included in this event. The field purge parameter data are presented in Table 2.2.

The field parameter data is collected primarily to assess stabilization of the parameters and to ensure that representative formation groundwater is being sampled. The field parameter data indicated that stabilization was achieved prior to sample collection. No odor or unusual color was observed in the purged water except at monitoring well MW95-1S, where a strong odor was observed.

2.3 LABORATORY ANALYTICAL RESULTS

The validated results for the laboratory analyses are presented in Tables 2.3 and 2.4 for VOCs and natural attenuation parameters, respectively. These results are summarized in the following sections. Temporal concentration trends were graphed for non-chlorinated analytes that exceeded Part 201 GSI Criteria at monitoring well MW95-1S. These graphs are presented on Figures 3.1 to 3.17.

2.3.1 VOLATILE ORGANIC COMPOUNDS

The validated VOC results from the groundwater samples are presented in Table 2.3 and are summarized below.

The following summarizes the concentrations of VOCs that exceeded their respective Part 201 GSI Criteria during the interim monitoring event:

Parameters	*Monitoring Well*	*Concentration (µg/L)*	*Part 201 GSI Criteria (µg/L)*
Ethylbenzene	MW95-1S	290	18
Toluene	MW95-1S	1,400	140
Vinyl Chloride	MW95-1S	1,100	15
Xylenes (Total)	MW95-1S	1,220	35

No compounds were detected above the Method Detection Limit (MDL) in monitoring wells MW84-2S and MW85-2S. The only compound detected at MW84-1S was 1,2,-dichloroethane at 13 µg/L which is significantly below the Part 201 GSI criteria of 360 µg/L.

As indicated above, Part 201 GSI criteria were exceeded at MW95-1S for ethylbenzene, toluene, vinyl chloride, and xylenes (total). Methylene chloride was detected at MW95-1S, though applicable Part 201 GSI criteria was not exceeded. 1,1-dichloroethane, chloroethane, and cis-1,2-dichloroethene were also detected at MW95-1S, however, there are no GSI criteria for these compounds. Chlorinated VOCs detected at MW95-1S were two to three orders of magnitude higher than those reported during the last monitoring event in October 1999.

2.3.2 NATURAL ATTENUATION PARAMETERS

Two monitoring wells were sampled for natural attenuation parameters (acid digestion, alkalinity, calcium, chloride, DOC, hardness, iron, magnesium, manganese, nitrate-nitrites, potassium, sodium, sulfate, and sulfide). The validated results of the natural attenuation parameters for monitoring wells MW84-1S and MW95-1S are presented in Table 2.4.

The analytical results for the natural attenuation parameters for MW84-1S and MW95-1S were comparable, but slightly lower, than those obtained during the previous event

except for sodium, which was slightly higher. The applicable groundwater criterion for each general chemistry parameter was not exceeded in any of the groundwater samples.

The natural attenuation parameter data will be fully evaluated in the Summary Report for the North Plume investigations. The data from MW95-1S indicate reducing conditions favorable for the degradation of chlorinated VOCs.

3.0 SUMMARY AND CONCLUSIONS

The following sections present the summary and conclusions of the June 2001 interim groundwater monitoring event at the Site.

3.1 VOLATILE ORGANIC COMPOUNDS

CRA compared the validated analytical results to the appropriate Part 201 GSI criteria, and to previous events. There were no VOCs detected at MW84-2S and MW85-2S. 1,2-dichloroethane was the only parameter detected at MW84-1S at 13 µg/L, which is below the Part 201 GSI criteria of 360 µg/L. These results are consistent with data from previous monitoring rounds.

In June 2001, Part 201 GSI criteria were exceeded at MW95-1S for ethylbenzene, toluene, vinyl chloride, and xylenes (total), 1,1-dichloroethane, chloroethane, cis-1,2-dichloroethene, and methylene chloride were detected at MW95-1S, though Part 201 GSI criteria, where applicable, were not exceeded.

All of the detected BTEX parameters at MW95-1S were lower than those observed during pervious sampling events. Chlorinated VOCs detected at MW95-1S were three orders of magnitude higher than those reported during the last annual monitoring event in October 1999.

Temporal trends of non-chlorinated VOCs that have exceeded Part 201 GSI Criteria at MW95-1S were analyzed, and are presented in graphical form on Figures 3.1 through 3.17.

3.1.1 ACETONE

Acetone was not detected in MW95-1S at a MDL of 2,000 µg/L. This reflects an overall decreasing concentration trend since December 1996, in which acetone was detected at a concentration of 20,000 µg/L. The concentration trend for acetone is presented on Figure 3.1.

3.1.2 TOLUENE

Toluene was detected in MW95-1S at 1,400 µg/L. This represents a substantial decrease since the October 1999 event, in which this compound was detected at 5,900 µg/L. This reflects an overall decreasing concentration trend since December 1996, in which toluene was detected at a concentration of 23,000 µg/L. The concentration trend for toluene is presented on Figure 3.2.

3.1.3 ETHYLBENZENE

Ethylbenzene was detected in MW95-1S at 290 µg/L. This represents a considerable decrease since the October 1999 event, in which ethylbenzene was detected at 1,000 µg/L. This reflects an overall decreasing concentration trend since December 1996, in which ethylbenzene was detected at a concentration of 4,800 µg/L. The concentration trend for ethylbenzene is presented on Figure 3.3.

3.1.4 MEK

MEK was not detected in MW95-1S at a MDL of 1,000 µg/L. This also reflects an overall decreasing concentration trend since December 1996, in which MEK was detected at a concentration of 26,000 µg/L. The concentration trend for MEK is presented on Figure 3.4.

3.1.5 MIBK

MIBK was not detected in MW95-1S at a MDL of 1,000 µg/L. This reflects an overall decreasing concentration trend since December 1996, in which MIBK was detected at a concentration of 29,000 µg/L. The concentration trend for MIBK is presented on Figure 3.5.

3.1.6 BENZENE

Benzene was not detected in MW95-1S at a MDL of 20 µg/L. This represents a decrease since the October 1999 event in which benzene was detected at 150 µg/L. This reflects a stable or perhaps decreasing concentration trend since March 1999, in which benzene

was detected at 62 µg/L. The concentration trend for benzene is presented on Figure 3.6.

3.1.7 TOTAL XYLENES

Total xylenes were detected in MW95-1S at 1220 µg/L. This represents a considerable decrease since the October 1999 event, in which total xylenes were detected at 3,600 µg/L. This reflects an overall decreasing concentration trend since December 1996, in which ethylbenzene was detected at a concentration of 21,000 µg/L. The concentration trend for total xylenes is presented on Figure 3.7.

3.1.8 CIS-1,2-DICHLOROETHENE

1,2-dichloroethene was detected in MW95-1S at 4,000 µg/L. This value is approximately three orders of magnitude greater than that from the October 1999 sampling event. MW95-1S was resampled and 1,2-dichloroethene was detected at 2,000 µg/L. The concentration trend for 1,2-dichloroethene is shown on Figure 3.8.

3.1.9 1,1-DICHLOROETHENE

1,1-dichloroethene was not detected at MW95-1S at a MDL of 20 µg/L. This reflects an overall decreasing concentration trend since December 1995, in which 1,1-dichloroethene was detected at a concentration of 512 µg/L. The concentration trend for 1,1-dichloroethene is presented on Figure 3.9.

3.1.10 TRICHLOROETHENE

Trichloroethene was not detected at MW95-1S at a MDL of 40 µg/L. This represents a relatively stable concentration since March 1997 when trichloroethene was detected at a concentration of 54 µg/L. The concentration trend for trichloroethene is shown on Figure 3.10.

3.1.11 1,1-DICHLOROETHANE

1,1-dichloroethane was detected at MW95-1S at a concentration of 3,800 µg/L. This represents an increase of approximately two orders of magnitude from the October 1999 sampling event. MW95-1S was resampled and 1,1-dichloroethane was not detected at a MDL of 50 µg/L. The concentration trend for 1,1-dichloroethane is shown on Figure 3.11.

3.1.12 1,2-DICHLOROETHANE

1,2-dichloroethane was not detected at MW95-1S at a MDL of 20 µg/L. This represents a relatively stable concentration since March 1999 when 1,2-dichloroethane was detected at a concentration of 32 µg/L. The concentration trend for 1,2-dichloroethane is shown on Figure 3.12.

3.1.13 1,2-DICHLOROPROPANE

1,2-dichloropropane was not detected at MW95-1S at a MDL of 20 µg/L. This represents a relatively stable concentration since March 1997 when 1,2-dichloropropane was detected at a concentration of 52 µg/L. The concentration trend for 1,2-dichloropropane is shown on Figure 3.13.

3.1.14 CHLOROBENZENE

Chlorobenzene was not detected at MW95-1S at a MDL of 20 µg/L. This represents a decreasing concentration trend since April 1999 when chlorobenzene was detected at a concentration of 99 µg/L. The concentration trend for chlorobenzene is shown on Figure 3.14.

3.1.15 CHLOROETHANE

Chloroethane was detected at MW95-1S at a concentration of 2,200 µg/L. This represents an increase of approximately 2 orders of magnitude from the October 1999 sampling event. MW95-1S was resampled and chloroethane was detected at a concentration of 3,600 µg/L. The concentration trend for chloroethane is shown on Figure 3.15.

3.1.16 VINYL CHLORIDE

Vinyl chloride was detected at MW95-1S at a concentration of 1,100 µg/L. This represents an increase of approximately three orders of magnitude from the October 1999 sampling event. MW95-1S was resampled and vinyl chloride was detected at a concentration of 950 µg/L. The concentration trend for vinyl chloride is shown on Figure 3.16.

3.1.17 METHYLENE CHLORIDE

Methylene chloride was detected at MW95-1S at a concentration of 190 µg/L. This represents an increase of approximately two orders of magnitude from the October 1999 sampling event. MW95-1S was resampled and methylene chloride was detected at a concentration of 300 µg/L. These concentrations represent an overall decreasing concentration trend since December 1996, when methylene chloride was detected at a concentration of 1,200 µg/L. The concentration trend for methylene chloride is shown on Figure 3.17.

3.2 NATURAL ATTENUATION PARAMETERS

The analytical results for the natural attenuation parameters (acid digestion, alkalinity, calcium, chloride, DOC, hardness, iron, magnesium, manganese, nitrate-nitrites, potassium, sodium, sulfate, and sulfide) for MW84-1S and MW95-1S were comparable, but slightly lower than those obtained during the previous event except for sodium which was slightly higher. The applicable groundwater criterion for each general chemistry parameter was not exceeded in any of the groundwater samples.

This parameter will be fully evaluated in the Summary Report for the North Plume investigations. The data from MW95-1S indicate reducing conditions favorable to the degradation of chlorinated VOCs.

4.0 RECOMMENDATIONS

The FWCC is currently completing additional investigations in the area of the Site north of the landfill. The investigations are scheduled to be completed in December 2001. Following the completion, a Summary Report, Evaluation of Remedial Measures, and revised Long-Term Monitoring Plan (LTMP) will be submitted to the U.S. EPA for review and approval in January 2002.

The revised LTMP will become the definitive monitoring document for the Site.

However, as discussed in CRA's July 10, 2001 letter, the need for any further interim monitoring will be assessed following the receipt of all additional investigation data. If required, the FWCC will recommend any additional interim monitoring.

FIGURES

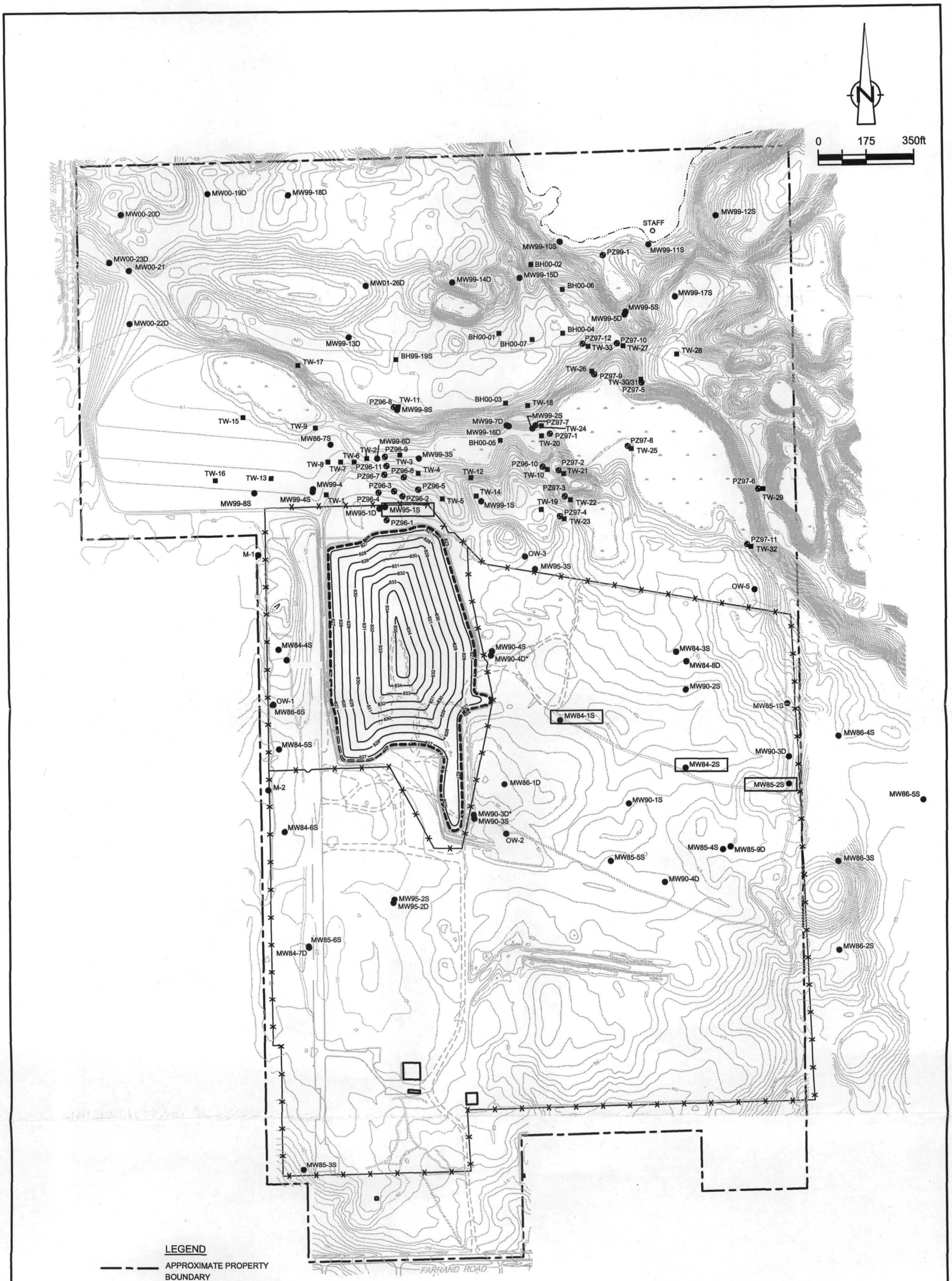

figure 1.1

SITE PLAN AND MONITORING NETWORK
FOREST WASTE SITE
Otisville, Michigan

12210-20(008)GN-WA001 SEP 14/2001

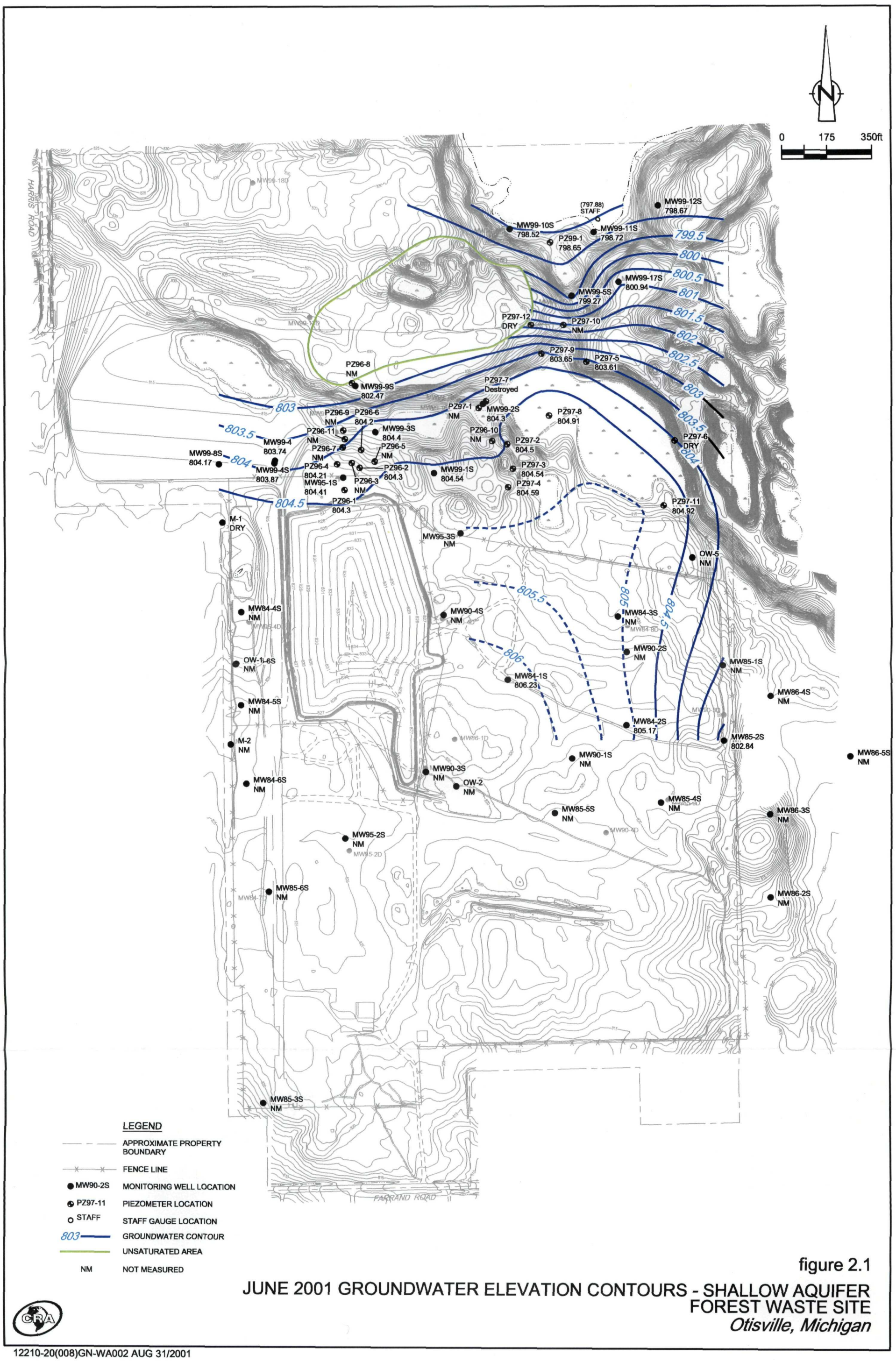

figure 2.1

JUNE 2001 GROUNDWATER ELEVATION CONTOURS - SHALLOW AQUIFER
FOREST WASTE SITE
Otisville, Michigan

12210-20(008)GN-WA002 AUG 31/2001

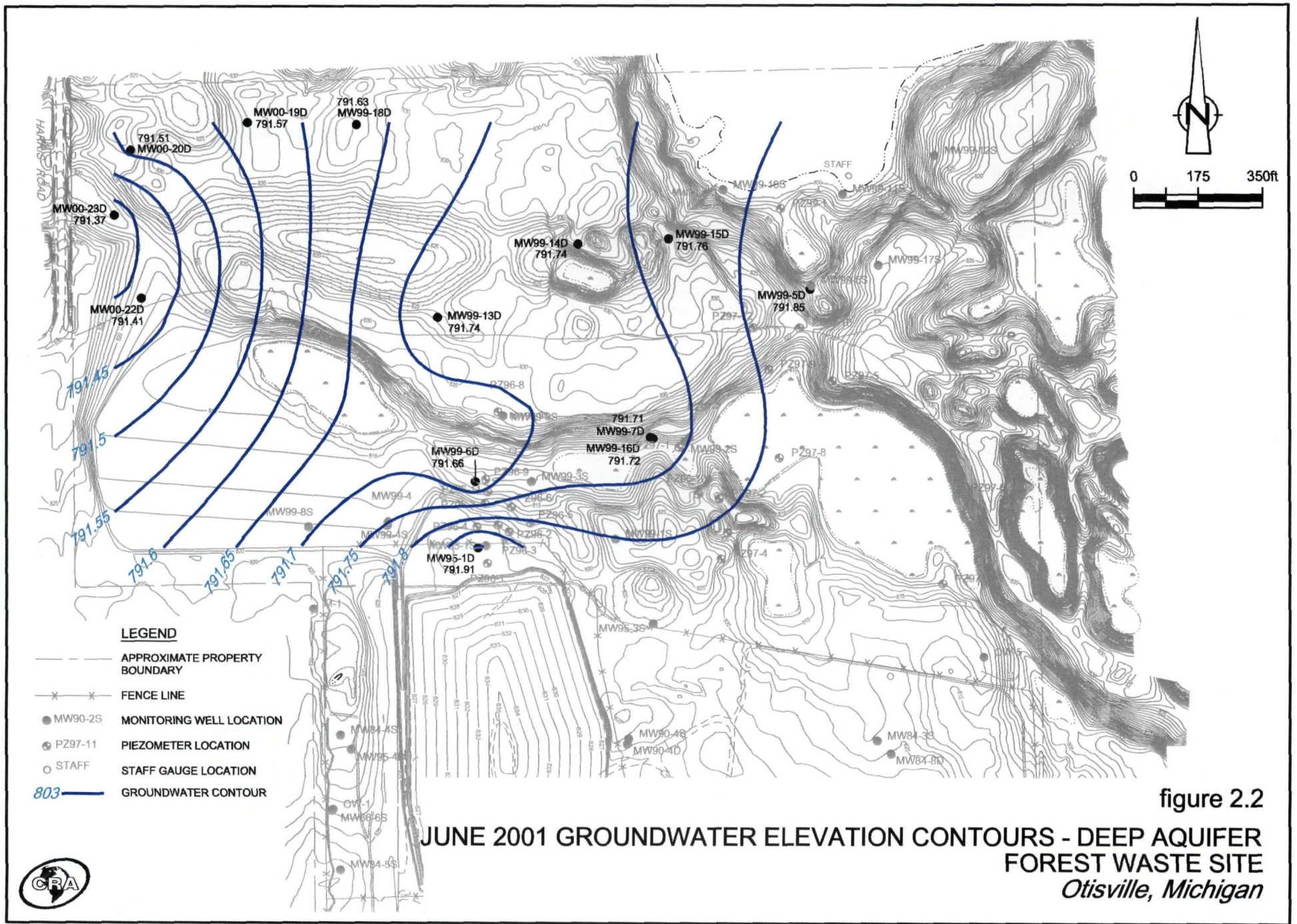

figure 2.2

JUNE 2001 GROUNDWATER ELEVATION CONTOURS - DEEP AQUIFER
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Otisville, Michigan

12210-20(008)GN-WA003 AUG 31/2001

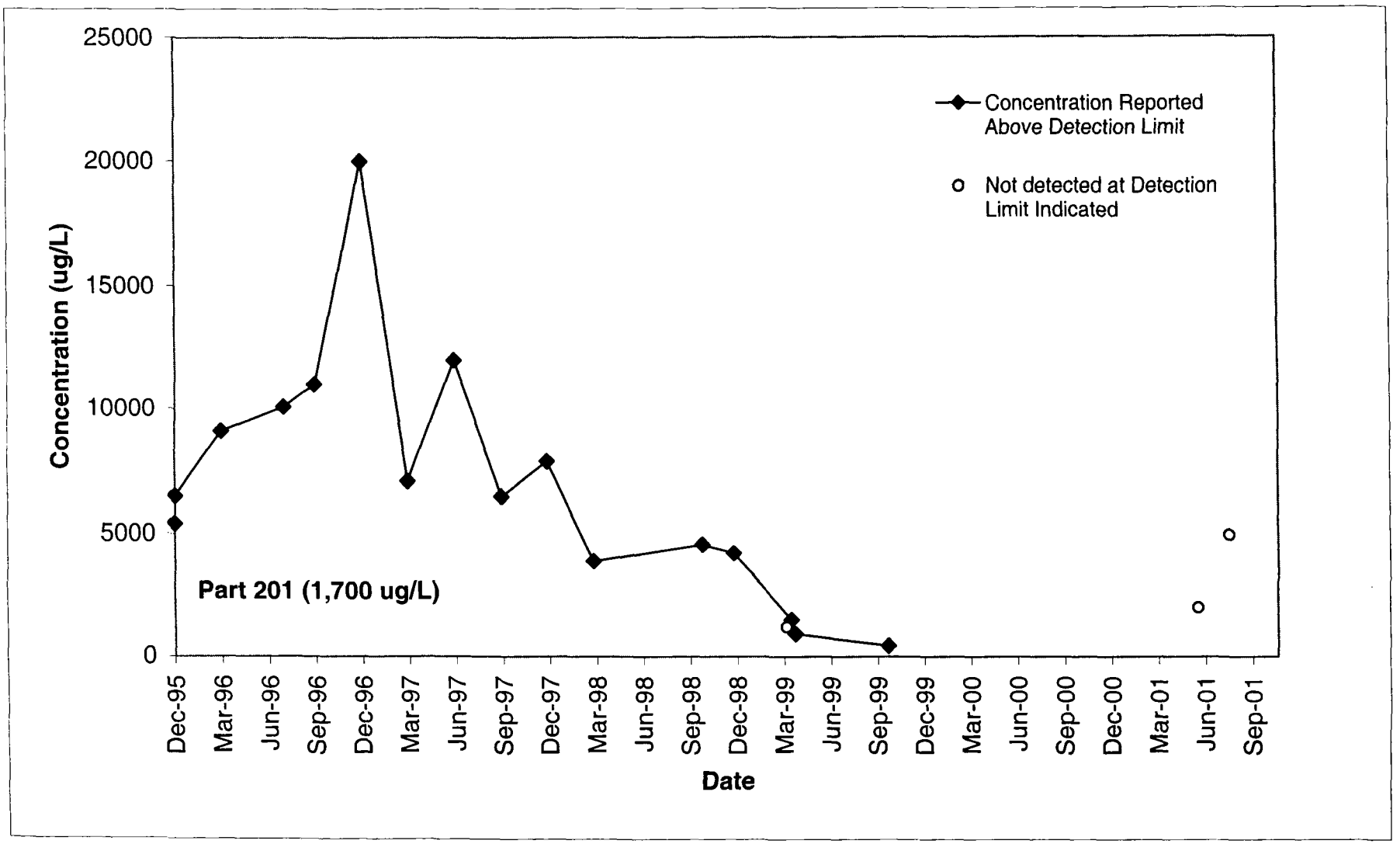

figure 3.1
MW95-1S ACETONE DATA
FOREST WASTE DISPOSAL SITE
OTISVILLE, MICHIGAN

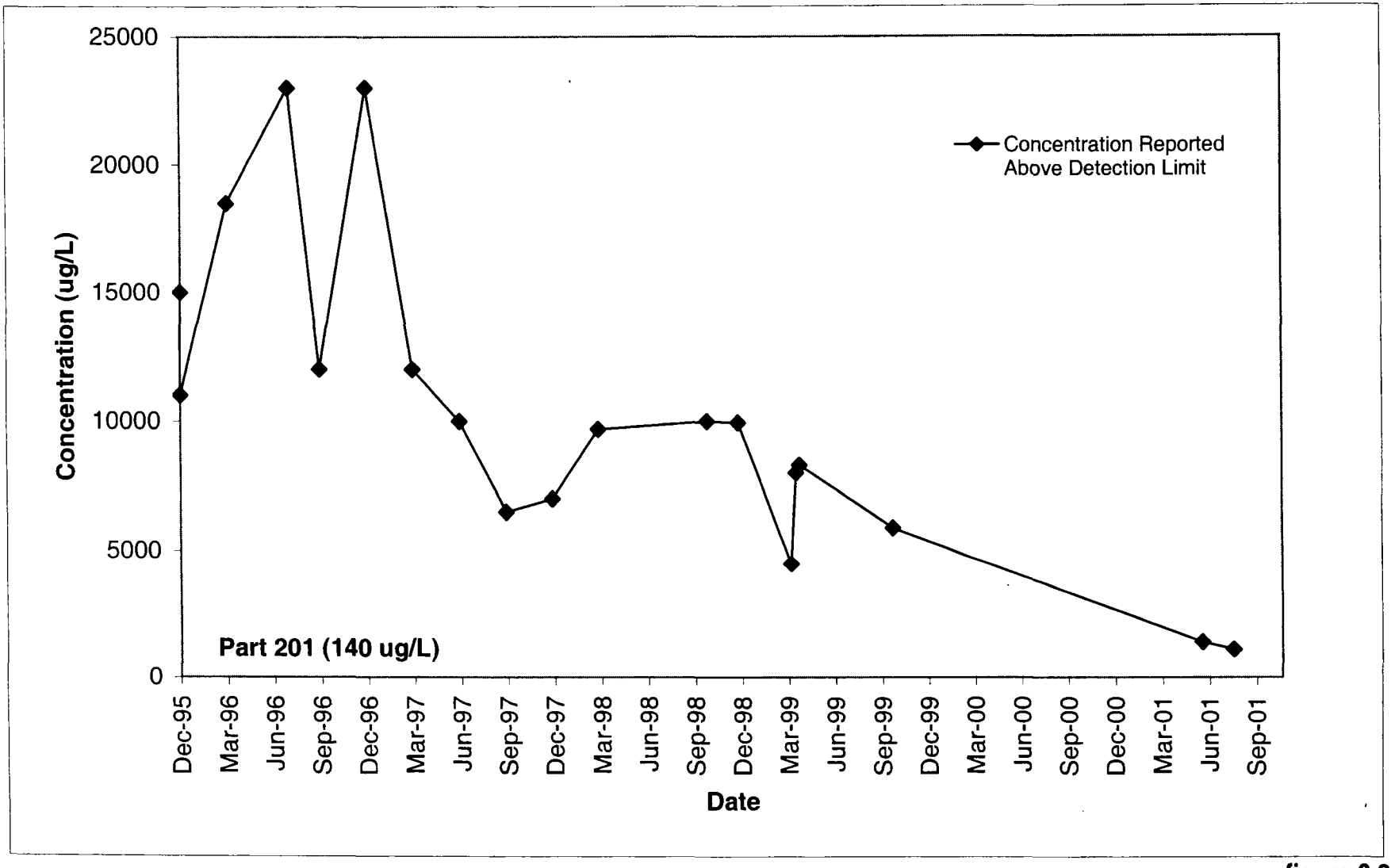

figure 3.2
MW95-1S TOLUENE DATA
FOREST WASTE DISPOSAL SITE
OTISVILLE, MICHIGAN

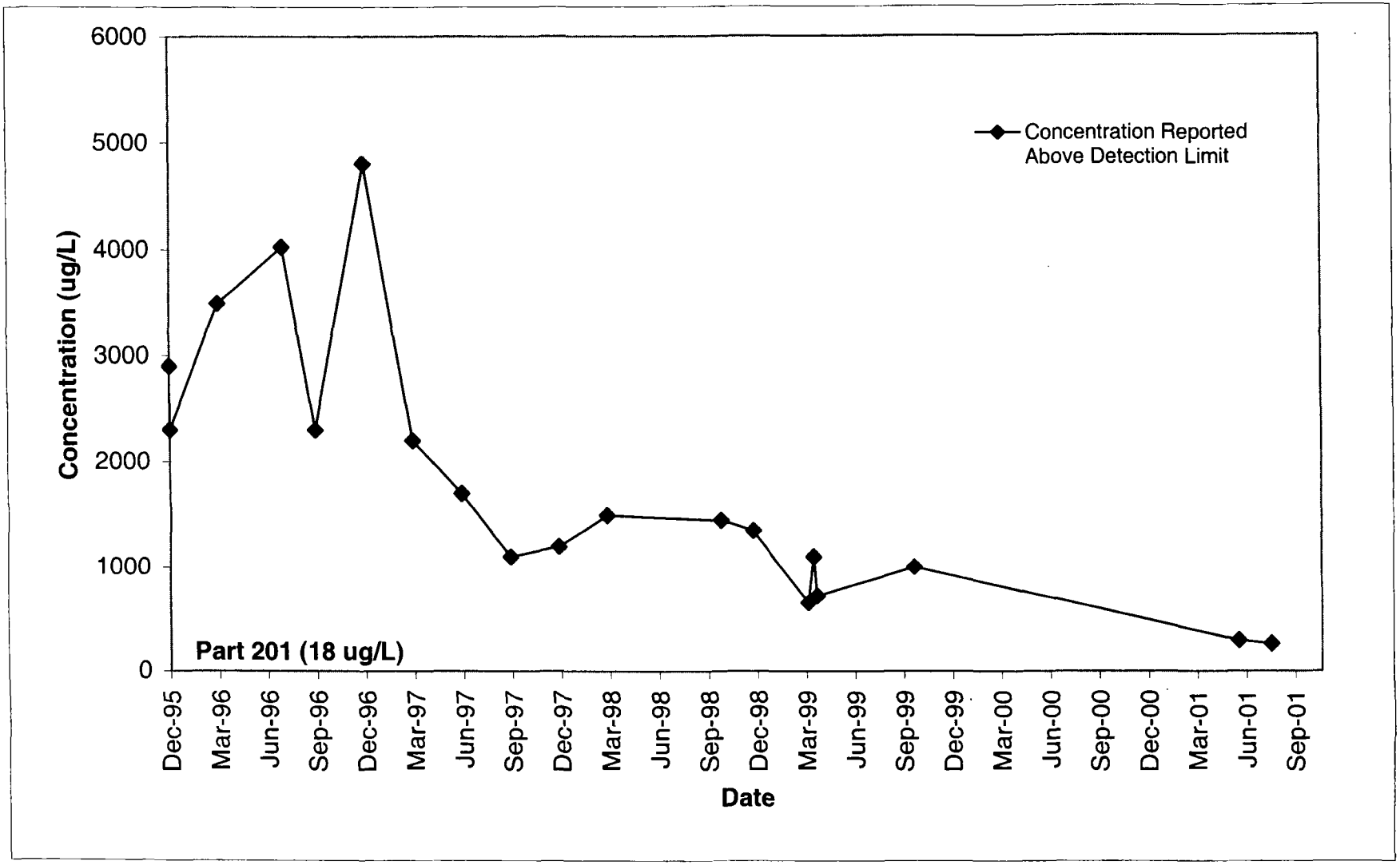

figure 3.3
MW95-1S ETHYLBENZENE DATA
FOREST WASTE DISPOSAL SITE
OTISVILLE, MICHIGAN

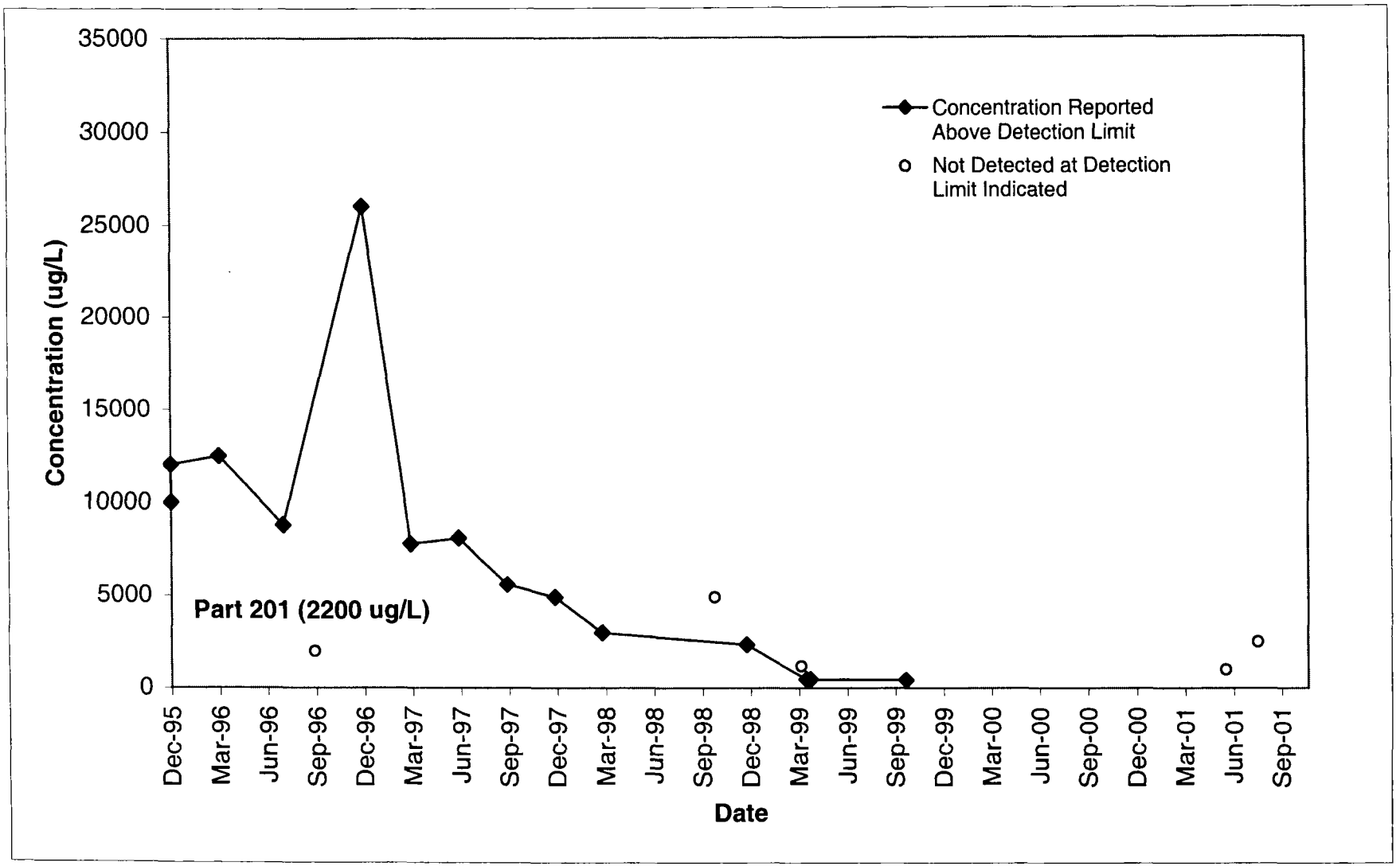

figure 3.4
MW95-1S MEK (2-BUTANONE) DATA
FOREST WASTE DISPOSAL SITE
OTISVILLE, MICHIGAN

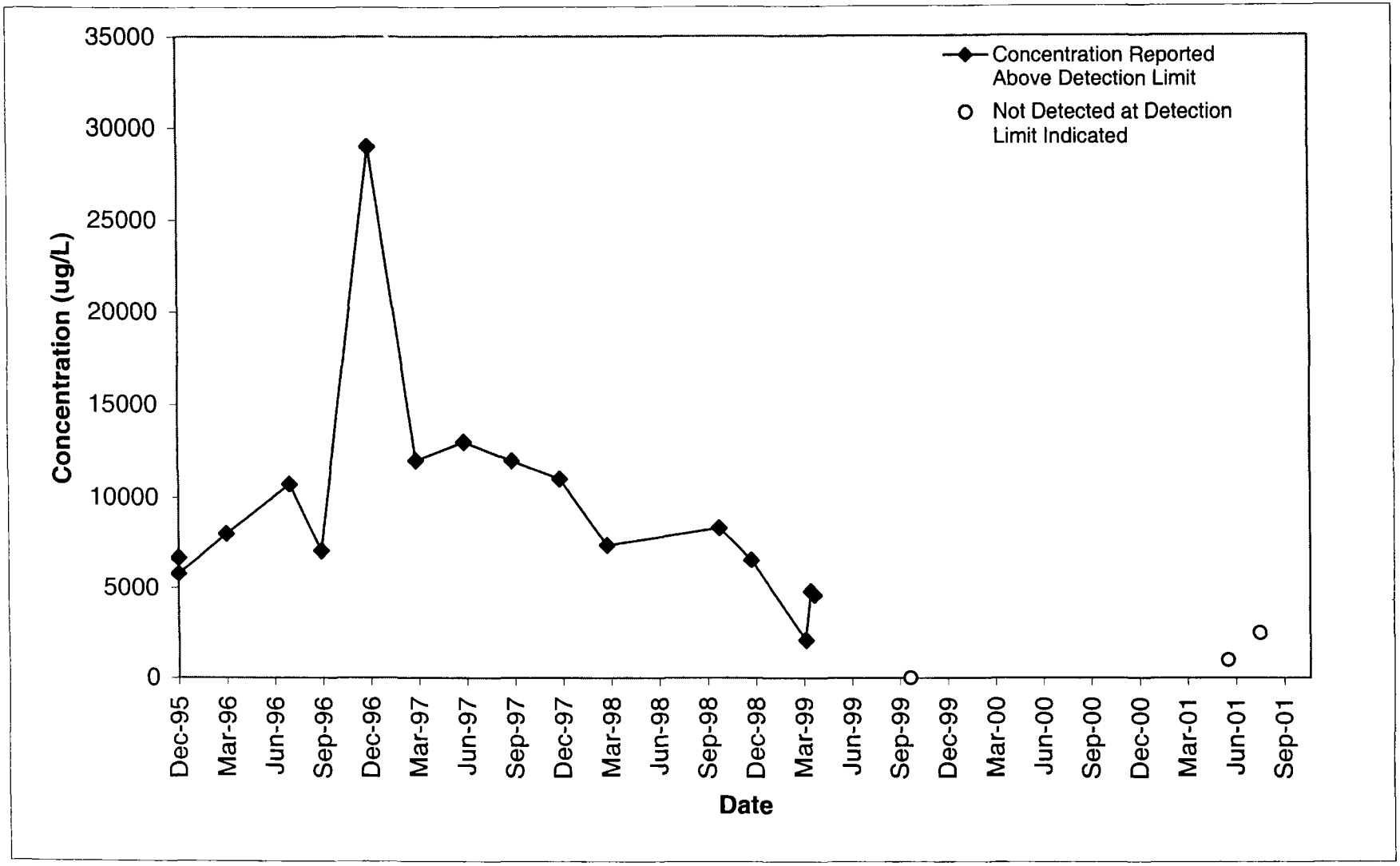

figure 3.5

MW95-1S MIBK (2-METHYL-4PENTANONE) DATA

FOREST WASTE DISPOSAL SITE

OTISVILLE, MICHIGAN

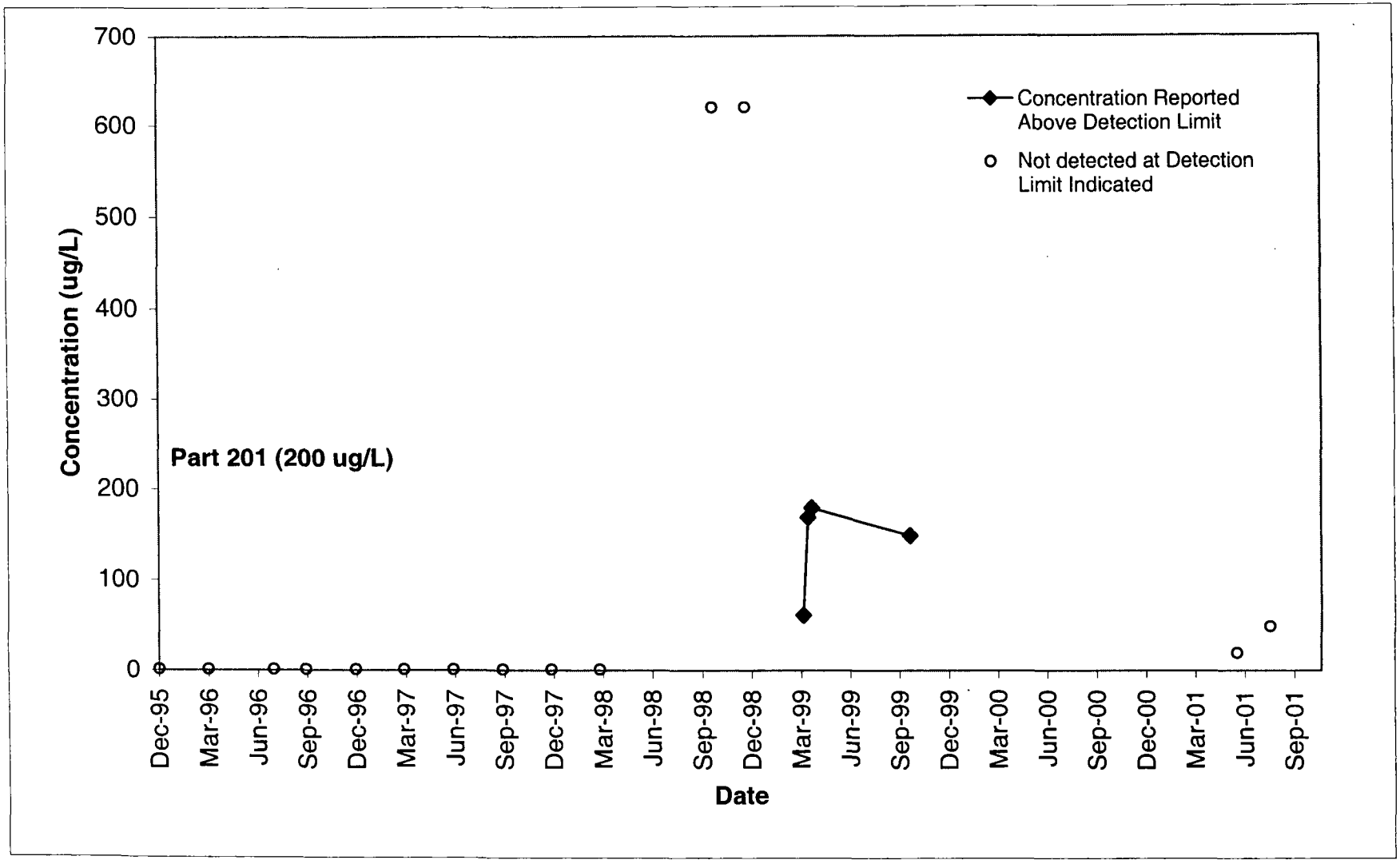

figure 3.6
MW95-1S BENZENE DATA
FOREST WASTE DISPOSAL SITE
OTISVILLE, MICHIGAN

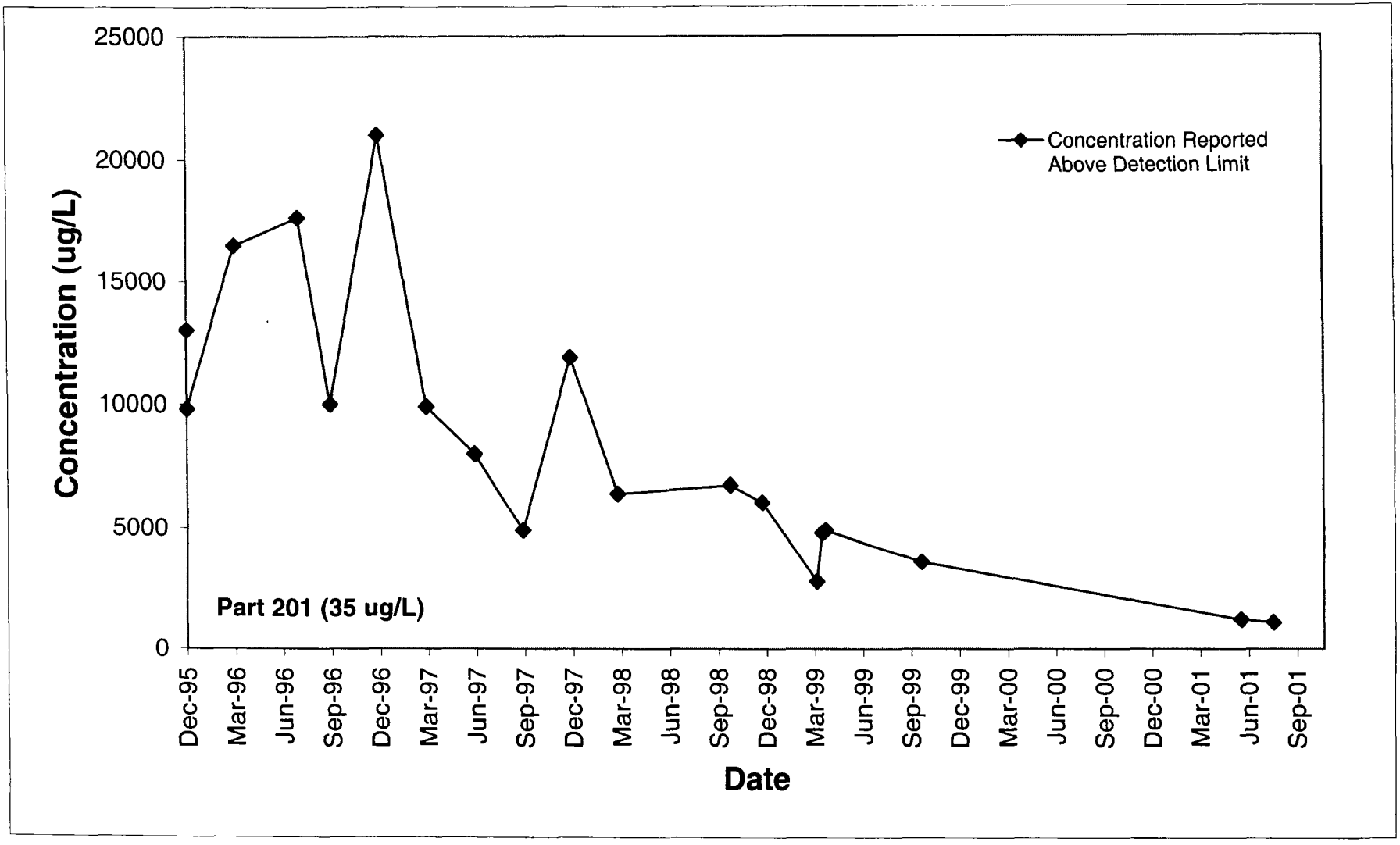

figure 3.7
MW95-1S TOTAL XYLENES DATA
FOREST WASTE DISPOSAL SITE
OTISVILLE, MICHIGAN

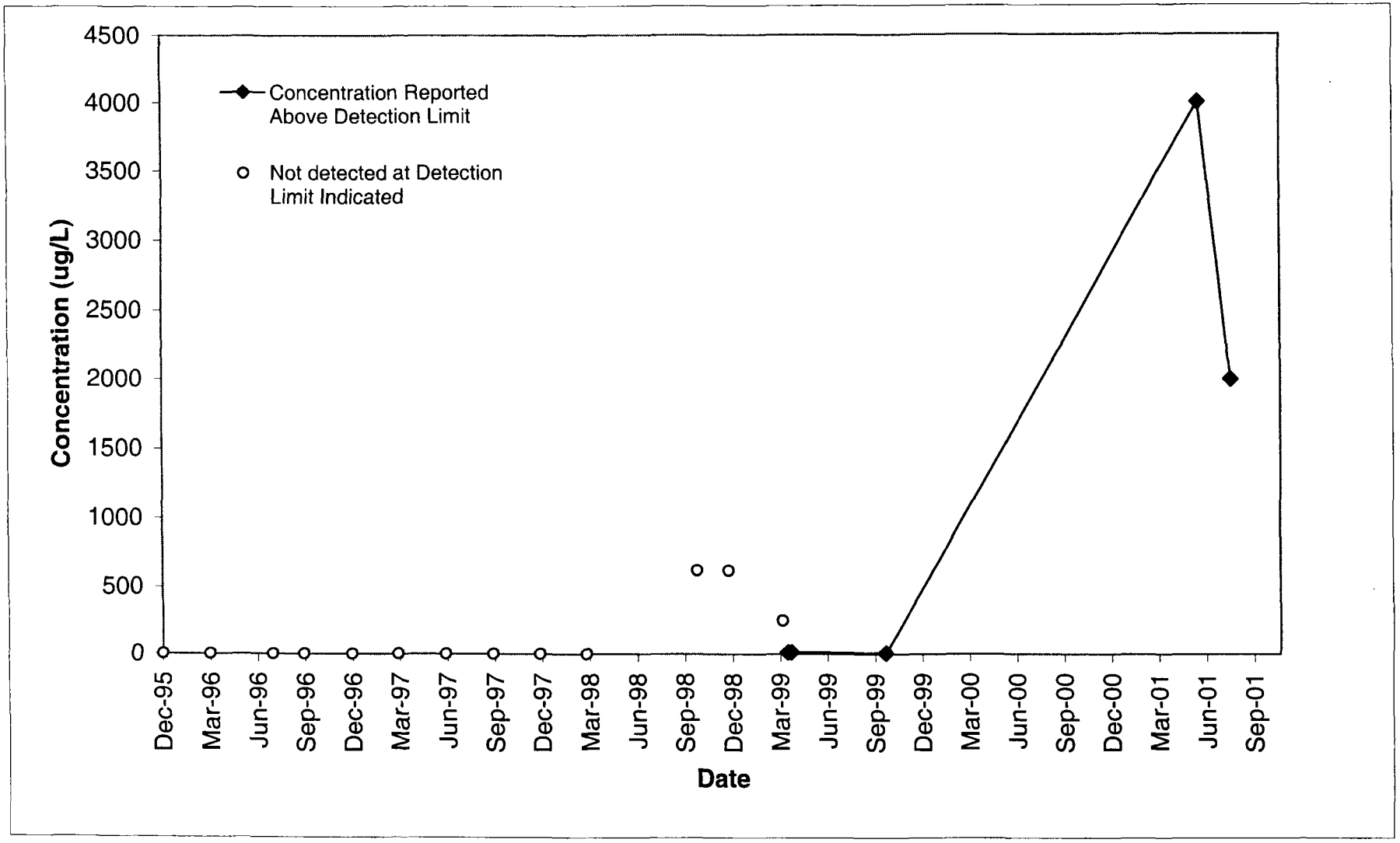

figure 3.8

MW95-1S CIS-1,2-DICHLOROETHENE DATA

FOREST WASTE DISPOSAL SITE

OTISVILLE, MICHIGAN

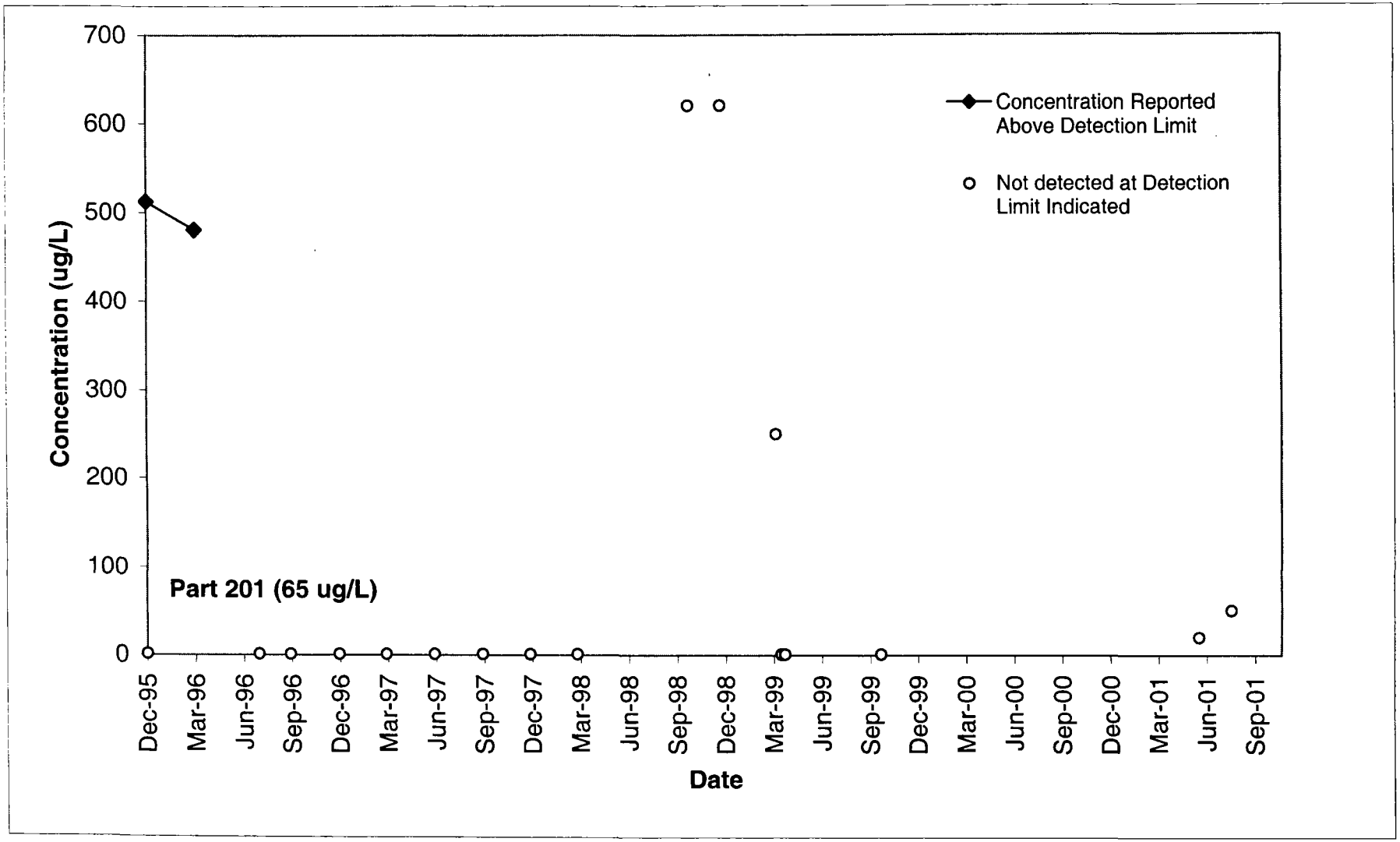

figure 3.9

MW95-1S 1,1 DICHLOROETHENE DATA

FOREST WASTE DISPOSAL SITE

OTISVILLE, MICHIGAN

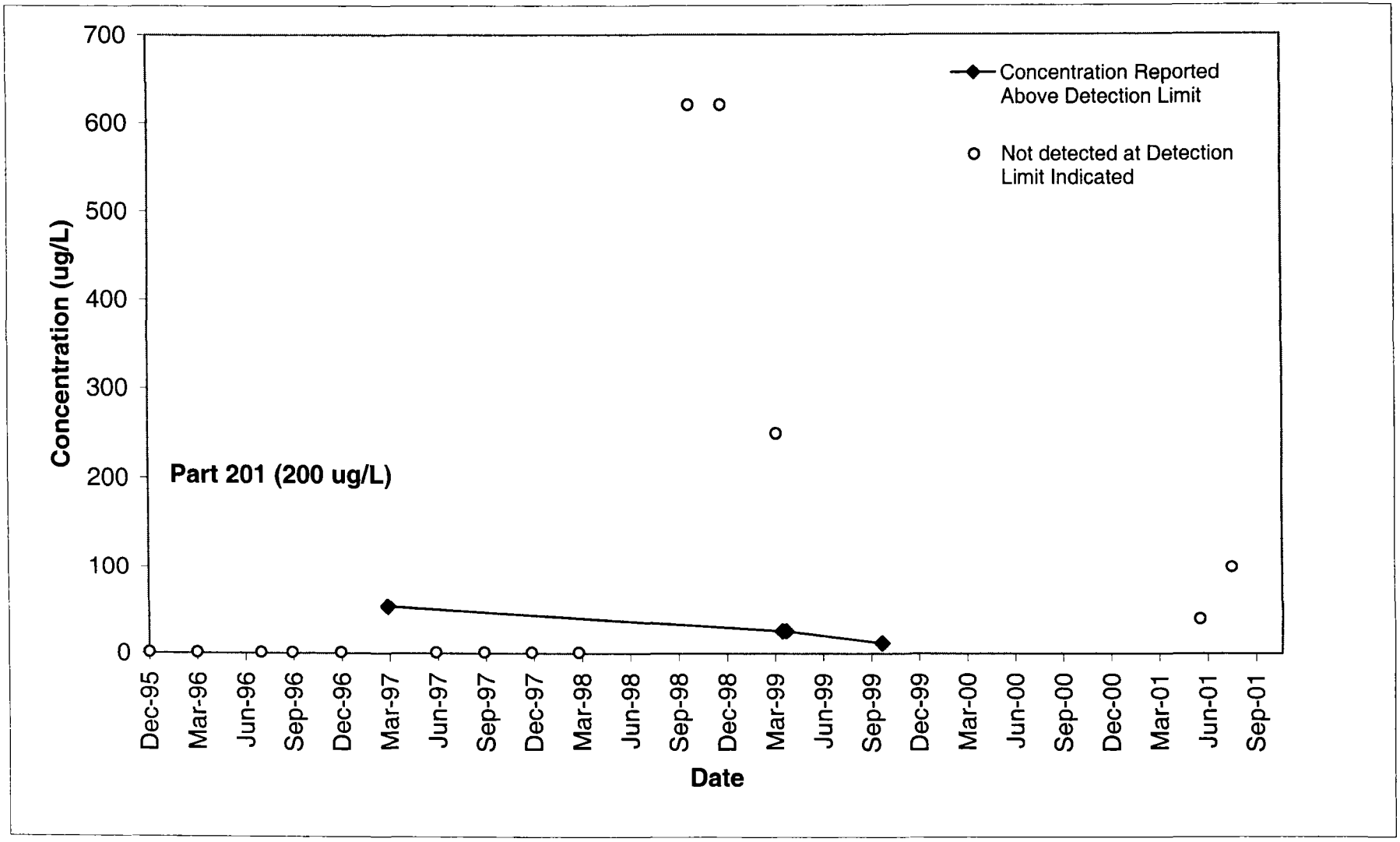

figure 3.10
MW95-1S TRICHLOROETHENE DATA
FOREST WASTE DISPOSAL SITE
OTISVILLE, MICHIGAN

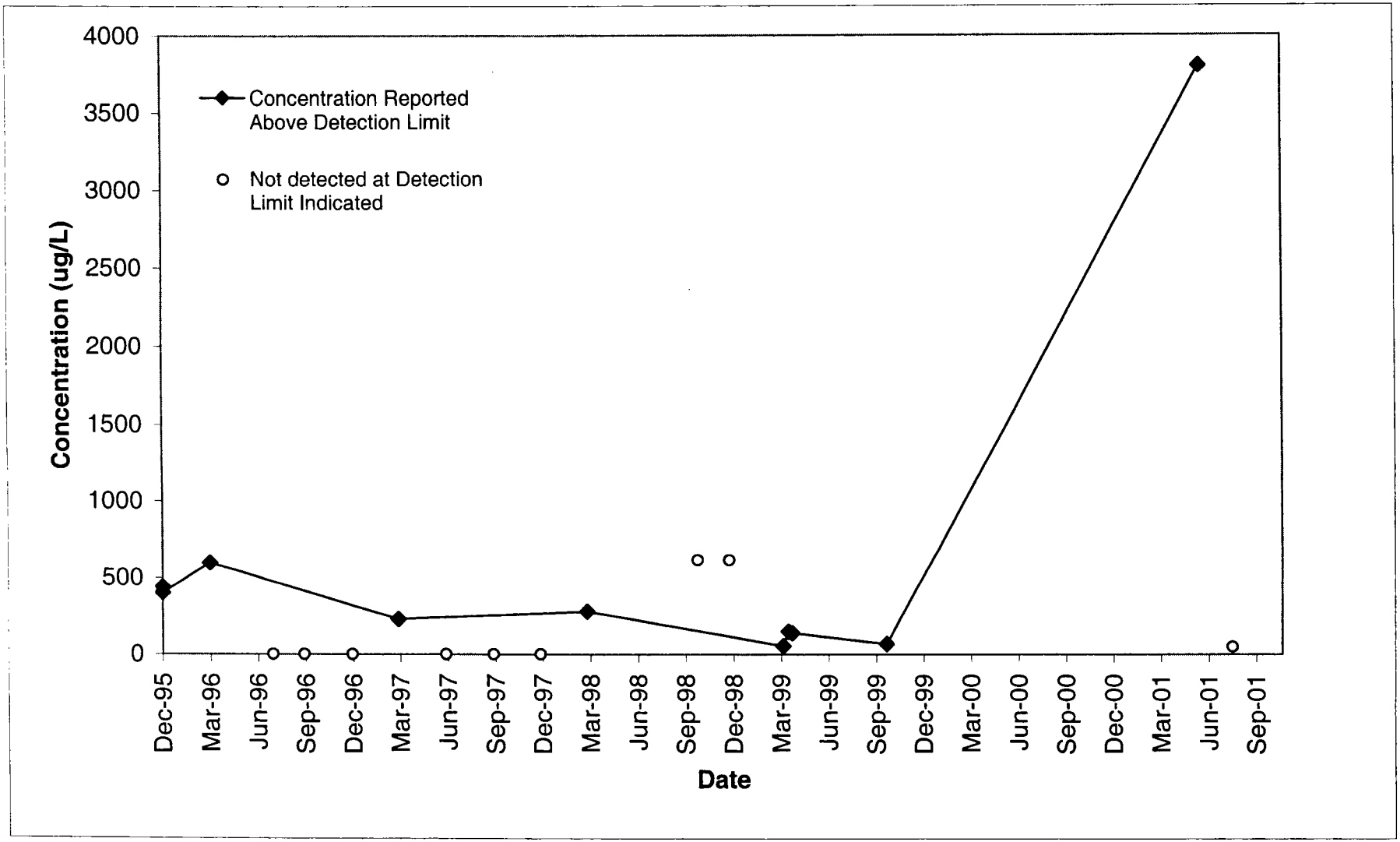

figure 3.11

MW95-1S 1,1-DICHLOROETHANE DATA

FOREST WASTE DISPOSAL SITE

OTISVILLE, MICHIGAN

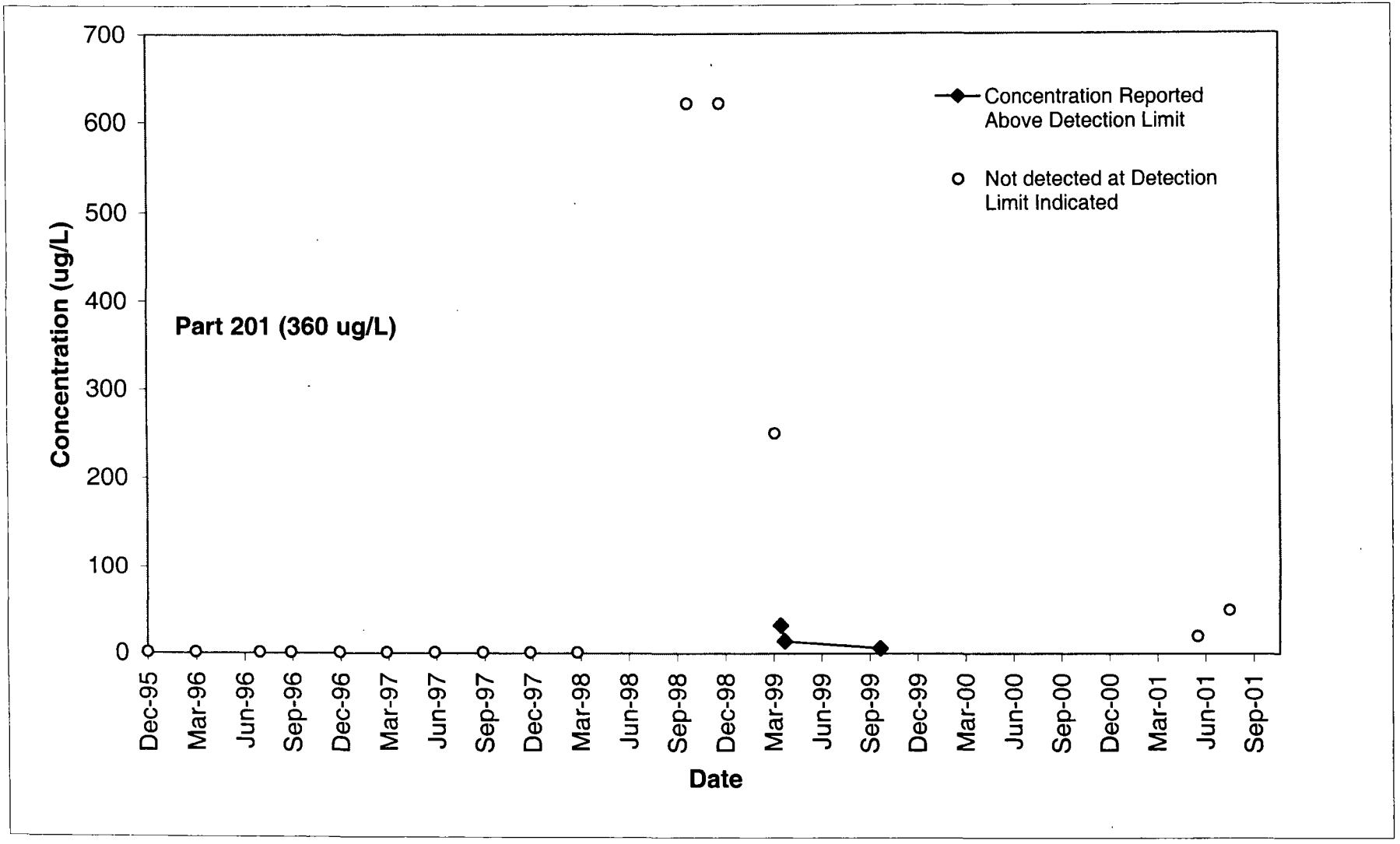

figure 3.12

MW95-1S 1,2-DICHLOROETHANE DATA
FOREST WASTE DISPOSAL SITE
OTISVILLE, MICHIGAN

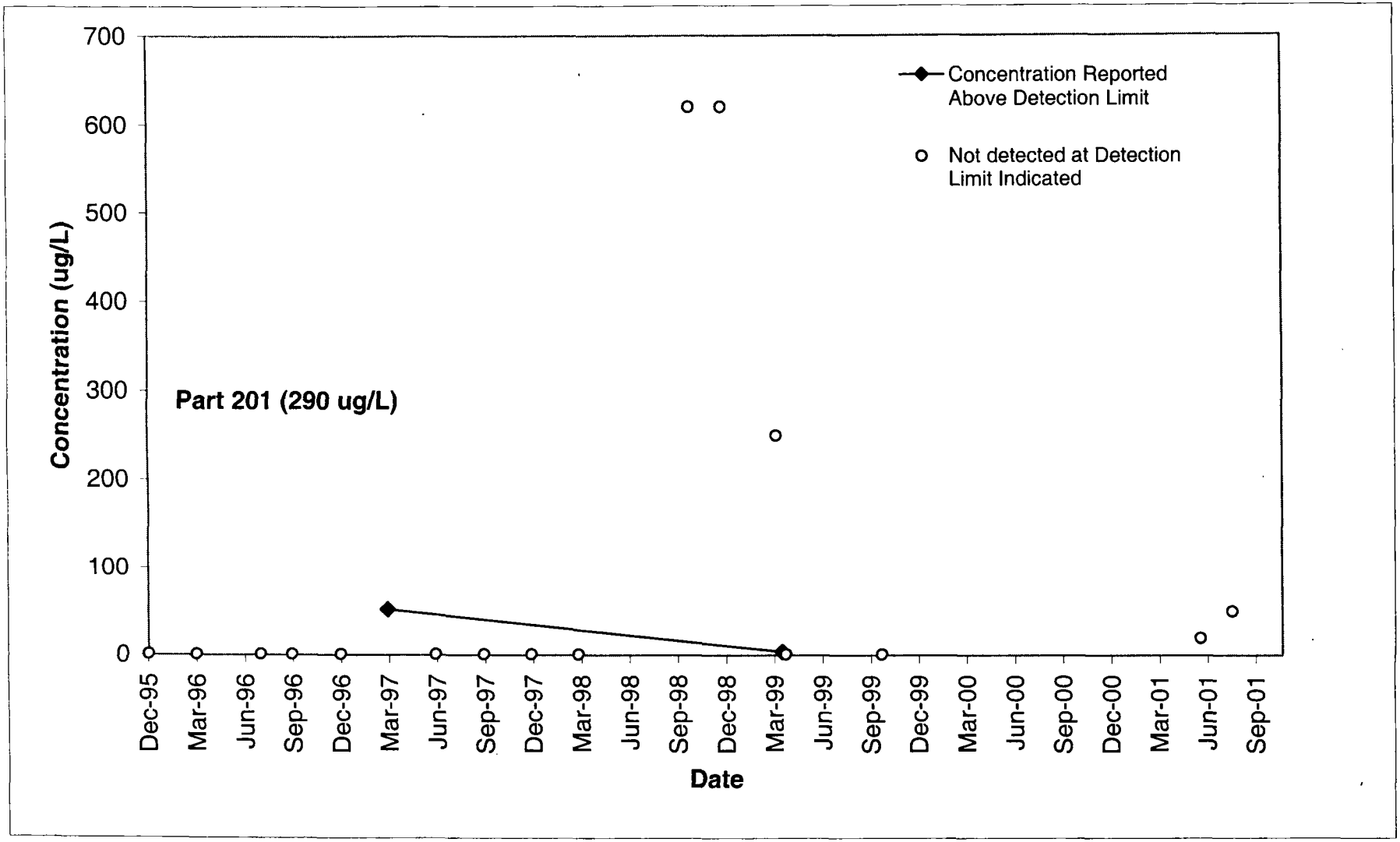

figure 3.13
MW95-1S 1,2-DICHLOROPROPANE DATA
FOREST WASTE DISPOSAL SITE
OTISVILLE, MICHIGAN

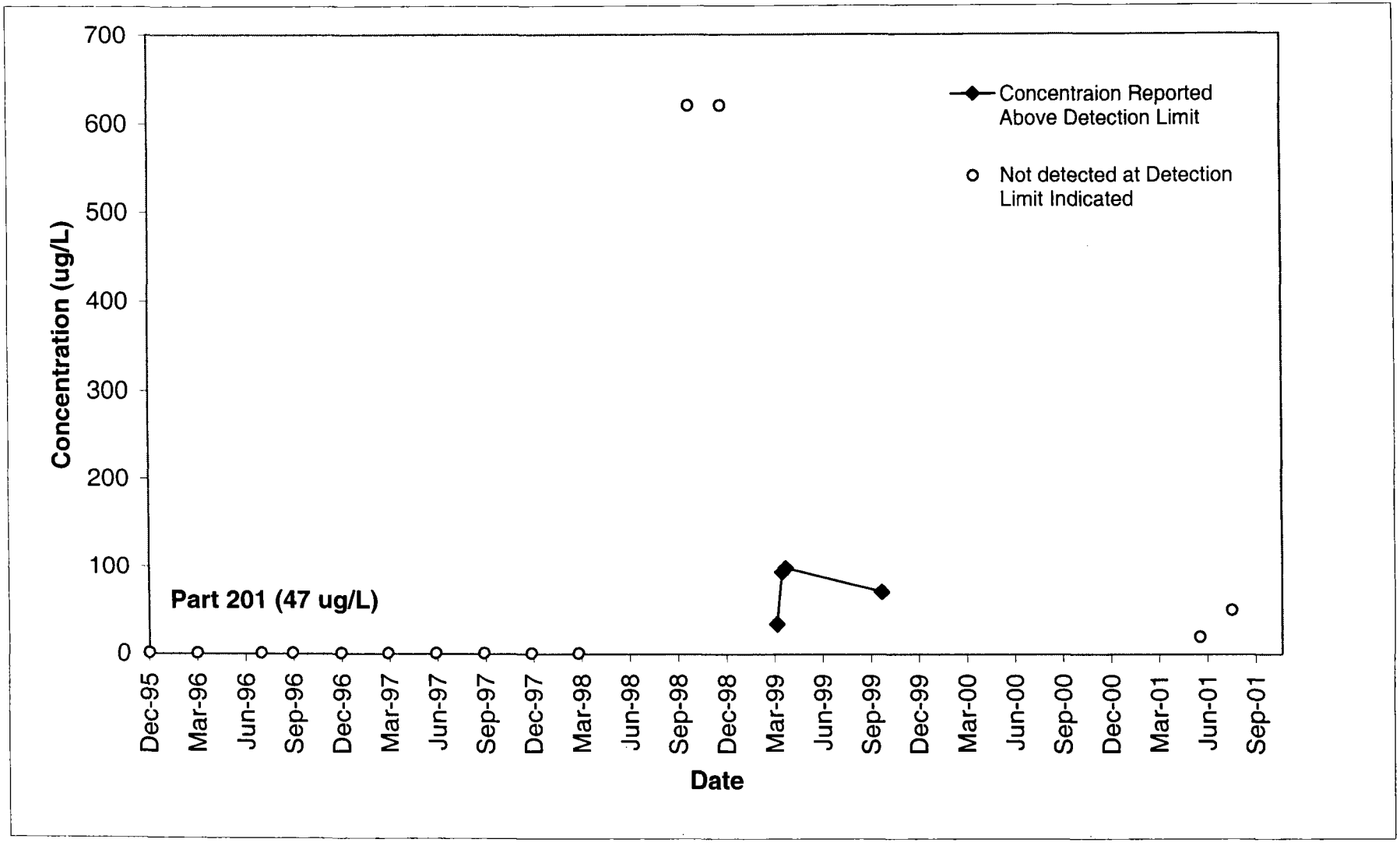

figure 3.14

MW95-1S CHLOROBENZENE DATA
FOREST WASTE DISPOSAL SITE
OTISVILLE, MICHIGAN

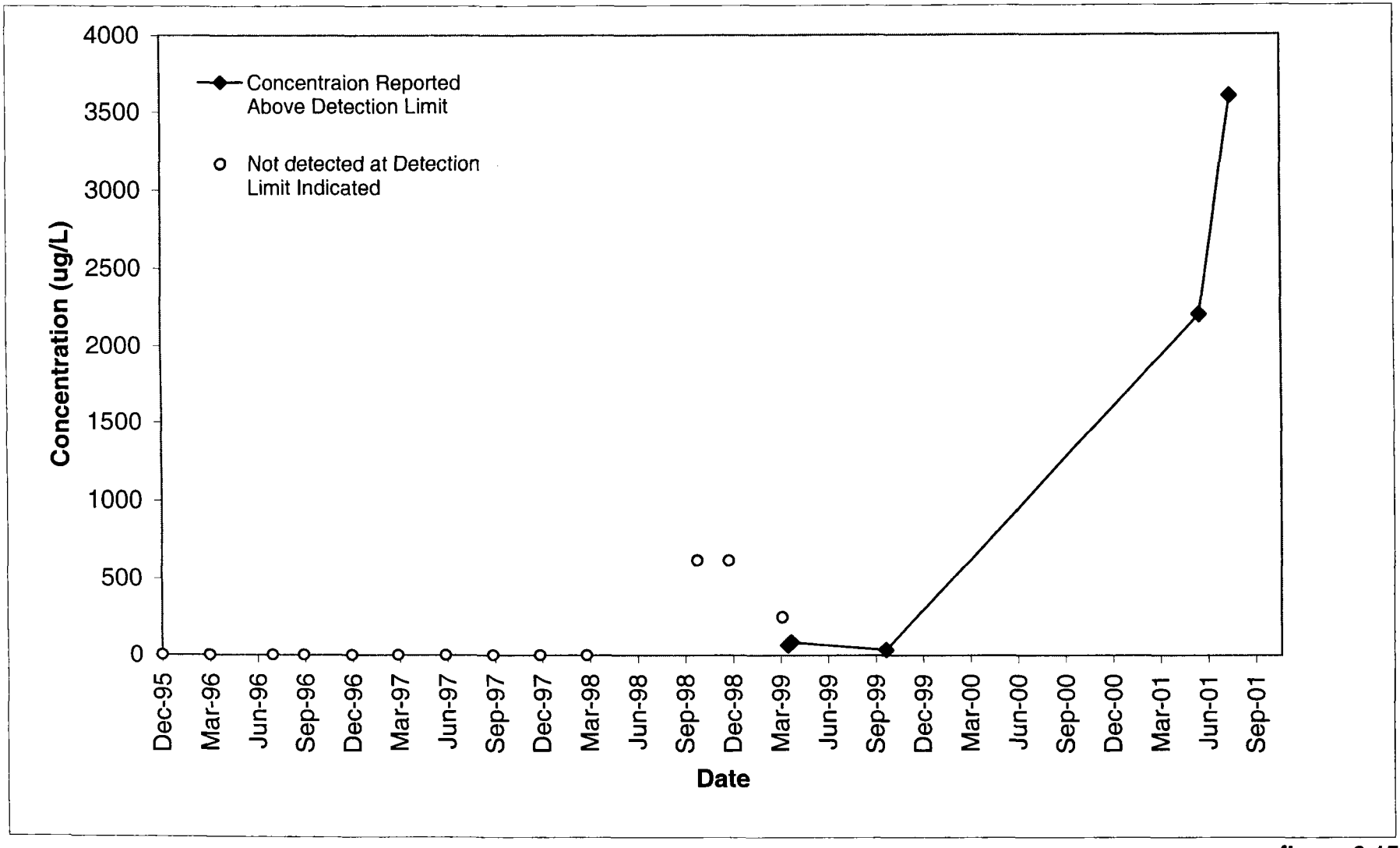

figure 3.15
MW95-1S CHLOROETHANE DATA
FOREST WASTE DISPOSAL SITE
OTISVILLE, MICHIGAN

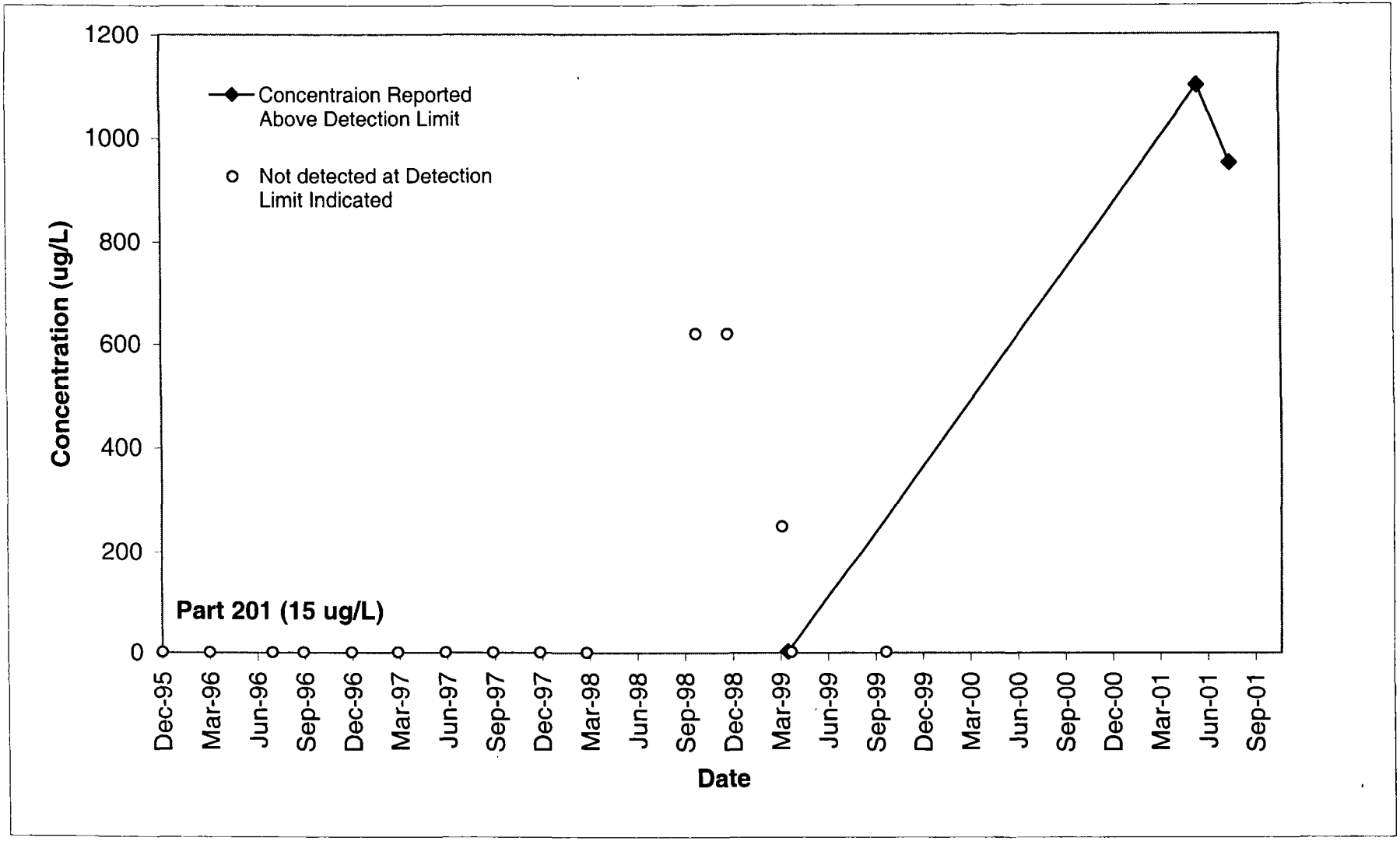

figure 3.16
MW95-1S VINYL CHLORIDE DATA
FOREST WASTE DISPOSAL SITE
OTISVILLE, MICHIGAN

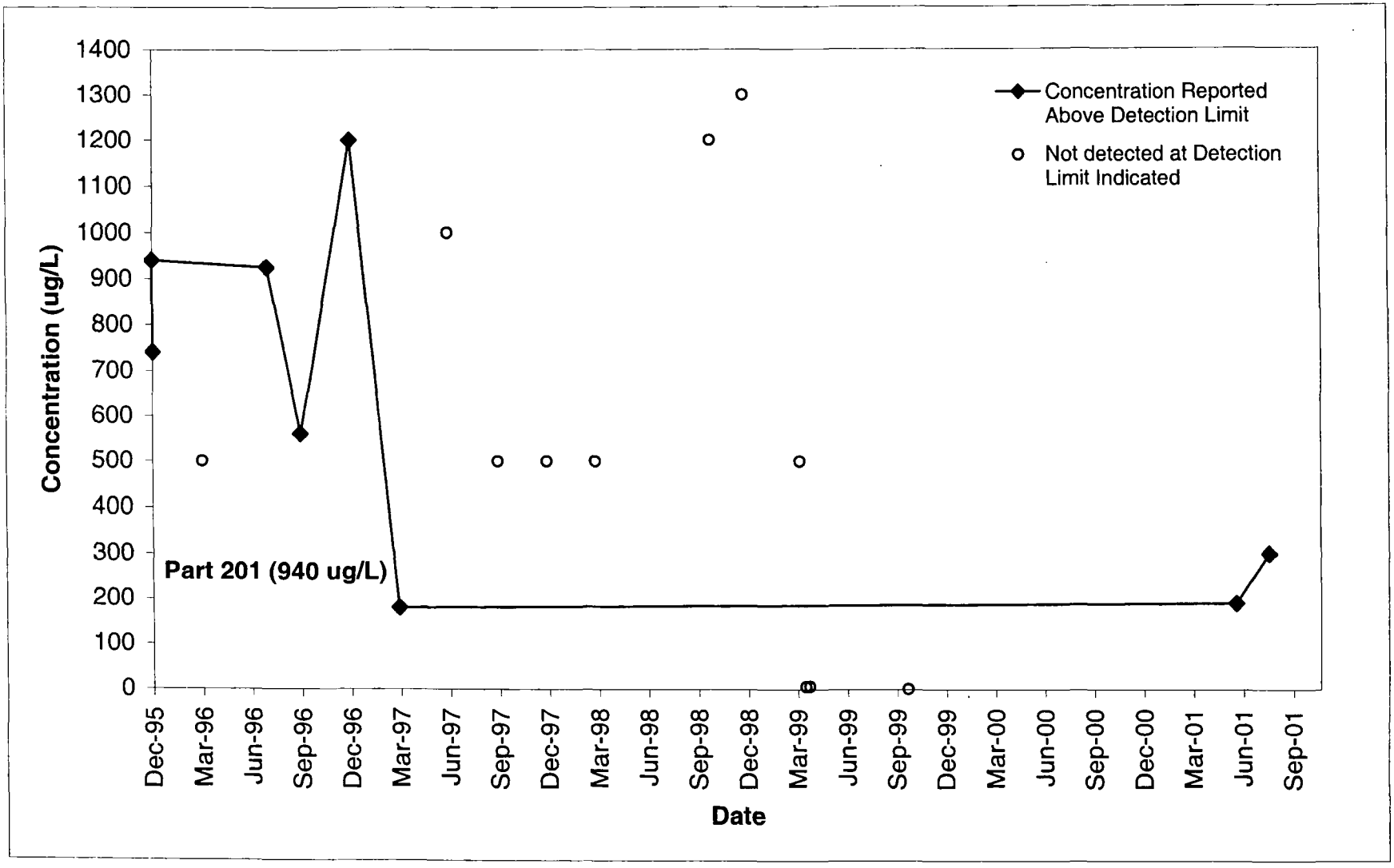

figure 3.17
MW95-1S METHYLENE CHLORIDE DATA
FOREST WASTE DISPOSAL SITE
OTISVILLE, MICHIGAN

TABLES

TABLE 2.1

SUMMARY OF GROUNDWATER ELEVATIONS
INTERIM GROUNDWATER MONITORING EVENT
FOREST WASTE SITE
OTISVILLE, MICHIGAN

	Monitor	Top of Casing Elevation *(feet AMSL)*	Depth to Water From Top of Casing *(feet)*	Groundwater Elevation *(feet AMSL)*
Shallow Wells				
	M-1	820.95	-	DRY
	MW95-1S	826.19	21.78	804.41
	PZ96-1	825.09	20.79	804.30
	PZ96-2	824.18	19.88	804.30
	PZ96-3	823.90	-	Destroyed
	PZ96-4	824.71	20.50	804.21
	PZ96-5	820.79	-	NM
	PZ96-6	819.95	15.75	804.20
	PZ96-7	819.60	-	NM
	PZ96-8	828.82	-	NM
	PZ96-9	815.39	-	NM
	PZ96-10	822.52	-	Destroyed
	PZ96-11	814.88	-	Damaged
	PZ97-1	815.04	-	NM
	PZ97-2	827.98	23.48	804.50
	PZ97-3	822.60	18.06	804.54
	PZ97-4	826.39	21.80	804.59
	PZ97-5	829.48	25.87	803.61
	PZ97-6	834.03	-	DRY
	PZ97-7	814.45	-	Damaged
	PZ97-8	814.29	9.38	804.91
	PZ97-9	816.35	12.70	803.65
	PZ97-10	822.20	-	NM
	PZ97-11	814.95	10.03	804.92
	PZ97-12	829.57	-	DRY
	MW99-1S	826.96	22.42	804.54
	MW99-2S	816.24	11.94	804.30
	MW99-3S	815.21	10.81	804.40
	MW99-4	820.26	16.52	803.74
	MW99-4S	820.16	16.29	803.87
	MW99-5S	812.67	13.40	799.27
	MW99-8S	821.56	17.39	804.17
	MW99-9S	830.58	28.11	802.47
	MW99-10S	802.34	3.82	798.52
	MW99-11S	801.48	2.76	798.72
	MW99-12S	821.15	22.48	798.67
	MW99-17S	831.13	30.19	800.94
	PZ99-1	804.41	5.76	798.65
	staff gauge	799.98	-	Destroyed

TABLE 2.1

SUMMARY OF GROUNDWATER ELEVATIONS
INTERIM GROUNDWATER MONITORING EVENT
FOREST WASTE SITE
OTISVILLE, MICHIGAN

	Monitor	Top of Casing Elevation *(feet AMSL)*	Depth to Water From Top of Casing *(feet)*	Groundwater Elevation *(feet AMSL)*
Deep Wells				
	MW95-1D	825.82	33.95	791.87
	MW99-13D	828.90	37.16	791.74
	MW99-14D	832.38	40.64	791.74
	MW99-15D	830.78	39.02	791.76
	MW99-16D	814.97	23.25	791.72
	MW99-18D	835.43	43.80	791.63
	MW99-5D	812.25	20.40	791.85
	MW99-6D	815.50	23.89	791.61
	MW99-7D	814.88	23.21	791.67
	MW00-19D	834.23	42.66	791.57
	MW00-20D	829.41	37.90	791.51
	MW00-21	823.07	30.85	792.22
	MW00-22D	822.18	30.77	791.41
	MW00-23D	820.75	29.38	791.37

NOTES:
NM: Not Measured

TABLE 2.2

MONITORING WELL FIELD PARAMETER DATA
FOREST WASTE SITE
OTISVILLE, MICHIGAN

Monitoring Well ID	*Sample Date*	*Depth to Well Bottom (feet BTOR)*	*Depth to Static Water (feet BTOR)*	*Water Column Height (feet)*	*Equivalent Well Volume (gallons)*	*Elapsed time (min)*	*rate (ml/min)*	*rate (gal/min)*	*Cumulative Volume Purged (gallons)*
MW84-1S	26-Jun-01	NM	20.37	NM	NM	10.00	500.00	0.13	1.3
						20.00	500.00	0.13	2.6
						25.00	500.00	0.13	3.3
						30.00	500.00	0.13	4.0
						35.00	500.00	0.13	4.6
MW84-2S	25-Jun-01	32.50	21.10	11.40	1.82	10.00	350.00	0.09	0.9
						15.00	350.00	0.09	1.4
						20.00	350.00	0.09	1.8
						25.00	350.00	0.09	2.3
						30.00	350.00	0.09	2.8
						35.00	350.00	0.09	3.2
						40.00	350.00	0.09	3.7
MW85-2S	25-Jun-01	22.00	18.18	3.82	0.61	10.00	300.00	0.08	0.8
						15.00	300.00	0.08	1.2
						20.00	300.00	0.08	1.6
						25.00	300.00	0.08	2.0
						30.00	300.00	0.08	2.4
						35.00	300.00	0.08	2.8
MW95-1S	27-Jun-01	33.00	21.78	11.22	1.79	10.00	500.00	0.13	1.3
						15.00	500.00	0.13	2.0
						20.00	500.00	0.13	2.6
						25.00	500.00	0.13	3.3
						30.00	500.00	0.13	4.0
						35.00	500.00	0.13	4.6
						40.00	500.00	0.13	5.3
MW95-1S	22-Aug-01	22.00	6.76	15.24	2.44	10.00	500.00	0.13	1.3
						15.00	500.00	0.13	2.0
						20.00	500.00	0.13	2.6
						25.00	500.00	0.13	3.3

TABLE 2.2

MONITORING WELL FIELD PARAMETER DATA
FOREST WASTE SITE
OTISVILLE, MICHIGAN

Monitoring Well ID	*pH*	*Temperature (^{0}C)*	*Specific Conductance (mS/cm)*	*Turbidity (NTU)*	*Color*	*Odor*	*DO*	*ORP*
MW84-1S	6.98	9.7	0.768	3.2	Clear	No	4.49	81
	6.79	9.6	0.785	2.6	Clear	No	3.07	68
	6.79	9.8	0.792	3.7	Clear	No	2.93	63
	6.80	9.7	0.792	4.1	Clear	No	2.95	62
	6.80	9.7	0.792	4.1	Clear	No	2.91	60
MW84-2S	7.23	11.9	0.929	2.3	Clear	No	0.33	-17
	7.28	11.6	0.947	2.1	Clear	No	0.23	-49
	7.30	11.2	0.950	1.9	Clear	No	0.19	-67
	7.33	11.1	0.951	1.9	Clear	No	0.16	-79
	7.32	11.0	0.955	1.1	Clear	No	0.14	-84
	7.32	11.1	0.955	0.6	Clear	No	0.11	-89
	7.35	11.1	0.955	0.5	Clear	No	0.12	-93
MW85-2S	7.30	9.9	0.821	1.2	Clear	No	0.39	25
	7.32	9.9	0.821	1.2	Clear	No	0.28	6
	7.34	9.8	0.821	0.8	Clear	No	0.28	-3
	7.35	9.9	0.820	0.8	Clear	No	0.21	-13
	7.36	9.9	0.824	0.8	Clear	No	0.23	-18
	7.37	9.9	0.821	0.4	Clear	No	0.21	-27
MW95-1S	7.21	10.8	1.580	3.9	Clear	Strong	2.91	-61
	7.21	11.4	1.600	3.1	Clear	Strong	2.56	-62
	7.22	11.1	1.600	2.6	Clear	Strong	1.96	-63
	7.22	11.3	1.600	2.5	Clear	Strong	1.96	-64
	7.22	11.2	1.590	3.0	Clear	Strong	1.59	-66
	7.22	11.2	1.600	3.6	Clear	Strong	1.57	-62
	7.23	11.3	1.610	3.5	Clear	Strong	1.55	-64
MW95-1S	7.67	10.8	1.550	6.7	Clear	Strong	NR	-135
	7.67	10.7	1.550	8.3	Clear	Strong	NR	-139
	7.66	10.8	1.560	3.3	Clear	Strong	NR	-140
	7.68	10.7	1.560	3.3	Clear	Strong	NR	-141

TABLE 2.3

GROUNDWATER ANALYTICAL DATA -VOCs
FOREST WASTE SITE
OTISVILLE, MICHIGAN

Well ID:	*MW84-1S*		*MW84-2S*	*MW85-2S*	*MW95-1S*	*MW95-1S*
Date:	*6/26/01*		*6/25/01*	*6/25/01*	*6/27/01*	*8/22/01*
Sample ID:	*11*	*12*	*5*	*4*	*34*	*18*
Benzene	ND(1)	ND(1)	ND(1)	ND(1)	ND(50)	ND(50)
Bromodichloromethane	ND(1)	ND(1)	ND(1)	ND(1)	ND(50)	ND(50)
Bromoform	ND(1)	ND(1)	ND(1)	ND(1)	ND(50)	ND(50)
Bromomethane	ND(2)	ND(2)	ND(2)	ND(2)	ND(100)	ND(100)
Carbon tetrachloride	ND(1)	ND(1)	ND(1)	ND(1)	ND(20)	380
Chlorobenzene	ND(1)	ND(1)	ND(1)	ND(1)	ND(50)	ND(50)
Chlorodibromomethane	ND(1)	ND(1)	ND(1)	ND(1)	ND(50)	ND(50)
Chloroethane	ND(2)	ND(2)	ND(2)	ND(2)	2200	3600
Chloroform	ND(1)	ND(1)	ND(1)	ND(1)	ND(50)	ND(50)
Chloromethane	ND(2)	ND(2)	ND(2)	ND(2)	ND(50)	ND(50)
1,1-Dichloroethane	ND(1)	ND(1)	ND(1)	ND(1)	3800	ND(50)
1,2-Dichloroethane	13	13	ND(1)	ND(1)	ND(50)	ND(50)
1,1-Dichloroethene	ND(1)	ND(1)	ND(1)	ND(1)	ND(50)	ND(50)
cis-1,2-Dichloroethene	ND(1)	ND(1)	ND(1)	ND(1)	4000	2200
trans-1,2-Dichloroethene	ND(1)	ND(1)	ND(1)	ND(1)	ND(50)	ND(50)
1,2-Dichloropropane	ND(1)	ND(1)	ND(1)	ND(1)	ND(50)	ND(50)
Ethylbenzene	ND(1)	ND(1)	ND(1)	ND(1)	290	260
Methylene chloride	ND(5)	ND(5)	ND(5)	ND(5)	190	300
Styrene	ND(1)	ND(1)	ND(1)	ND(1)	ND(50)	ND(50)
1,1,2,2-Tetrachloroethane	ND(1)	ND(1)	ND(1)	ND(1)	ND(50)	ND(50)
Tetrachloroethene	ND(2)	ND(2)	ND(2)	ND(2)	ND(100)	ND(100)
Toluene	ND(1)	ND(1)	ND(1)	ND(1)	1400	1100
1,1,1-Trichloroethane	ND(1)	ND(1)	ND(1)	ND(1)	ND(50)	ND(50)
1,1,2-Trichloroethane	ND(1)	ND(1)	ND(1)	ND(1)	ND(50)	ND(50)
Trichloroethene	ND(2)	ND(2)	ND(2)	ND(2)	ND(100)	ND(100)
Vinyl chloride	ND(1)	ND(1)	ND(1)	ND(1)	1100	950
Xylenes (total)	ND(3)	ND(3)	ND(3)	ND(3)	1220	1100
Acetone	ND(100)	ND(100)	ND(100)	ND(100)	ND(5000)	ND(5000)
Carbon Disulfide	ND(5)	ND(5)	ND(5)	ND(5)	ND(2500)	ND(2500)
2-Butanone	ND(50)	ND(50)	ND(50)	ND(50)	ND(2500)	ND(2500)
1,2-Dichloroethene (total)	ND(1)	ND(1)	ND(1)	ND(1)	4000	2000
4-Methyl-2-Pentanone	ND(50)	ND(50)	ND(50)	ND(50)	ND(2500)	ND(2500)
cis-1,3-Dichloropropene	ND(1)	ND(1)	ND(1)	ND(1)	ND(50)	ND(50)
trans-1,3-Dichloropropene	ND(1)	ND(1)	ND(1)	ND(1)	ND(50)	ND(50)
2-Hexanone	ND(50)	ND(50)	ND(50)	ND(50)	ND(2500)	ND(2500)
m,p-Xylene(s)	ND(2)	ND(2)	ND(2)	ND(2)	860	810
o-Xylene	ND(1)	ND(1)	ND(1)	ND(1)	360	300

Note:

All concentrations in µg/L

TABLE 2.4

GROUNDWATER ANALYTICAL DATA - NATURAL ATTENUATION PARAMETERS
FOREST WASTE SITE
OTISVILLE, MICHIGAN

Well ID:	*MW84-1S*		*MW95-1S*
Date:	*6/26/01*		*6/27/01*
Sample ID:	*11*	*12*	*34*
Alkalinity, as CaCO3	410	420	500
Chloride	5	9	154
Sulfate	76	65	5
Calcium, Total	98.5	96.6	83.4
Hardness-Total as CaCO3	452	500	680
Potassium, Total	3.45	3.57	10.3
Magnesium, Total	48.0	47.8	107
Sodium, Total	ND	ND	52
Iron, Dissolved	3.38	3.45	8.34
Manganese, Dissolved	0.201	ND	0.059
Dissolved Organic Carbon	5	9	279
Sulfide	--	--	0.08
Nitrate-Nitrite, as N	2.37	2.37	1.20
ORP (mV)	60		-64
DO	2.91		1.55

Note:

All concentrations in mg/L

APPENDICES

APPENDIX A

DATA QUALITY ASSESSMENT AND VALIDATION MEMORANDUM

CONESTOGA-ROVERS & ASSOCIATES

11100 Metro Airport Center Drive, Suite #160
Romulus, Michigan 48174
Telephone: (734) 942-0909 Fax: (734) 942-1858
www.CRAworld.com

MEMORANDUM

TO:	Jody Vaillancourt	REF. NO.:	12210
FROM:	Kathy Hasenfratz/kh/17/Det.	DATE:	August 20, 2001
RE:	Data Quality Assessment and Validation Groundwater Monitoring Forest Waste Site – Otisville, Michigan		

The following details a quality assessment and validation of the analytical data resulting from the June 25, 26 and 27, 2001, collection of four (4) groundwater and one (1) quality control sample from the Forest Waste Site in Otisville, Michigan. The sample summary detailing sample identification, sample location, quality control sample, and analytical parameters is presented in Table 1. Additional sample analysis and samples will be validated under a separate memorandum. Sample analysis was completed at Southern Petroleum Laboratories, Inc. in Lafayette Louisiana (SPL) in accordance with Method 8260B from "Test Methods for Evaluating Solid Waste, Physical/Chemical Methods", SW-846, 3rd Edition and Promulgated Updates, November 1986. The quality control criteria used to assess the data were established by the methods.[1]

Holding Time Period and Sample Analysis

The holding time periods for volatile organic compounds (VOC) analysis is 14 days from sample collection until completion of analysis. The samples, as indicated by the sample collection, extraction and analysis dates on the chain-of-custody forms and analytical reports provided by SPL were prepared and analyzed within the required holding time periods.

Method Blank Samples

Contamination of samples contributed by laboratory conditions or procedures was monitored by concurrent preparation and analysis of method blank samples. The method blank samples were reported to be free from detectable concentrations of target analytes, indicating no laboratory-attributable contamination occurred.

Laboratory Control Sample Analysis

The laboratory control sample (LCS) analyses serve as a monitor of the overall performance in all steps of the sample analysis. The LCS percent recoveries were within the laboratory control limits, indicating that an acceptable level of overall performance was achieved.

[1] Application of quality assurance criteria was consistent with "USEPA Contract Laboratory Program National Functional Guidelines for Organic Data Review", EPA-540/R-99/008 October 1999.

Surrogate Compound Percent Recoveries (Surrogate Recoveries)

Individual sample performance for the organic analyses was monitored by assessing the results of surrogate compound percent recoveries. The surrogate recovery acceptance criteria was met for all samples.

Matrix Spike/Matrix Spike Duplicate Percent Recoveries

To assess the long term accuracy and precision of the analytical methods on various matrices, matrix spike/matrix spike duplicate (MS/MSD) percent recoveries and the relative percent difference (RPD) of the concentrations were determined. The MS/MSD percent recoveries and associated RPDs acceptance criteria were met for all analyses.

Field Quality Assurance/Quality Control

The field quality assurance/quality control consisted of three (3) field blanks (rinsate) samples, one (1) field duplicate sample set and three (3) trip blank samples.

To assess the efficiency of field decontamination procedures, rinsate samples (GW-12210-DD-062601-13, GW-12210-DD-062601-16, and GW-12210-DD-062701-27) were collected and analyzed for target compound list (TCL) VOC. No targeted analytes were reported as detected in the rinsate samples.

Overall precision for the sampling event and laboratory procedures was monitored using the results of the field duplicate sample set. Table 2 summarizes the results of the detected analytes in the field duplicate sample set. The data indicate that an adequate level of precision was achieved for the sampling event.

To monitor potential cross-contamination of VOC during aqueous sample transportation and storage, a trip blank was submitted to the laboratory for VOC analysis with each shipping cooler. No target analytes were reported as detected in the trip blank samples.

Overall Assessment

The data were found to exhibit acceptable levels of accuracy and precision, based on the provided information, and may be used.

TABLE 2

SUMMARY OF DETECTED ANALYTES IN FIELD DUPLICATE SAMPLE SET
FOREST WASTE SITE
OTISVILLE, MICHIGAN

Parameter (µg/L)	*Investigative Sample*	*Duplicate Sample*	*RPD* [1]
	GW-12210-DD-062601-11	GW-12210-DD-062601-12	
TCL VOC			
1,2-Dichloroethane	13	13	0

[1] RPD - Relative Percent Difference

TABLE 1

SAMPLE SUMMARY
FOREST WASTE SITE
OTISVILLE, MICHIGAN

Sample Identification	*Sample Location*	*Matrix*	*QC Sample*	*Parameter*
GW-12210-DD-062501-04	MW85-2S	Water		TCL VOC
GW-12210-DD-062501-05	MW84-2S	Water		TCL VOC
GW-12210-DD-062601-11	MW84-1S	Water		TCL VOC
GW-12210-DD-062601-12	MW84-1S	Water	Duplicate (11)	TCL VOC
GW-12210-DD-062601-13	--	Water	Rinsate Blank	TCL VOC
GW-12210-DD-062601-16	--	Water	Rinsate Blank	TCL VOC
GW-12210-DD-062701-34	MW95-1S	Water		TCL VOC
GW-12210-DD-062701-27	--	Water	Rinsate Blank	TCL VOC

TCL - Target Compound List

VOC - Volatile Organic Compounds

QC - Quality Control